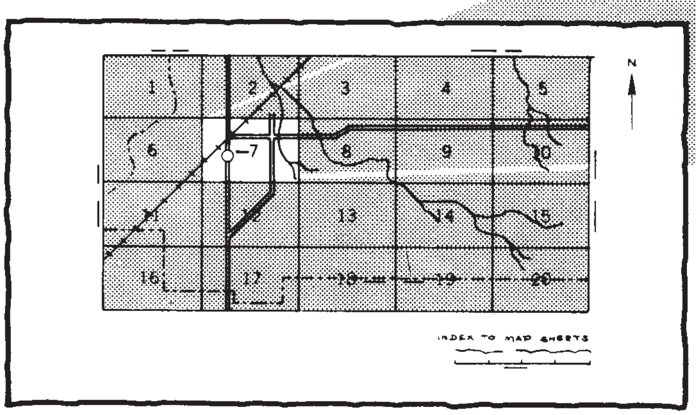
SOIL SURVEY OF

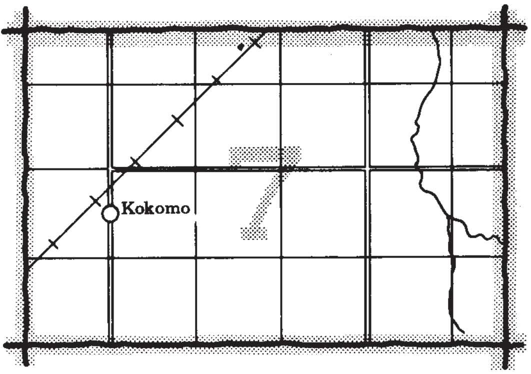
Midland County, Michigan

United States Department of Agriculture
Soil Conservation Service

HOW TO USE

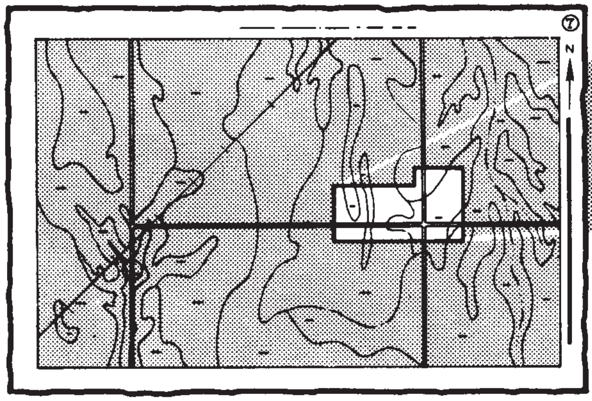
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

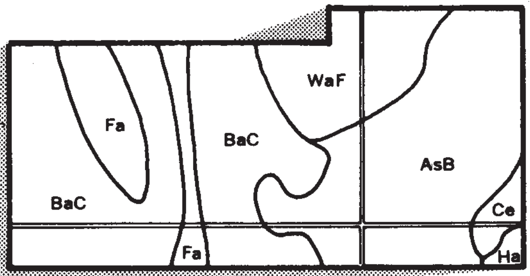

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
N
INDEX TO MAP SHEETS



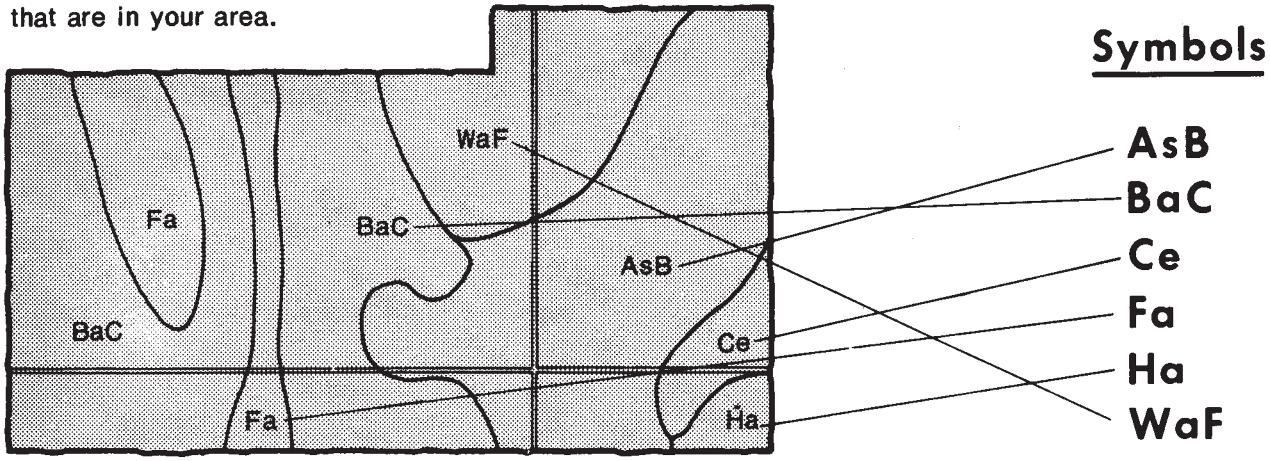
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



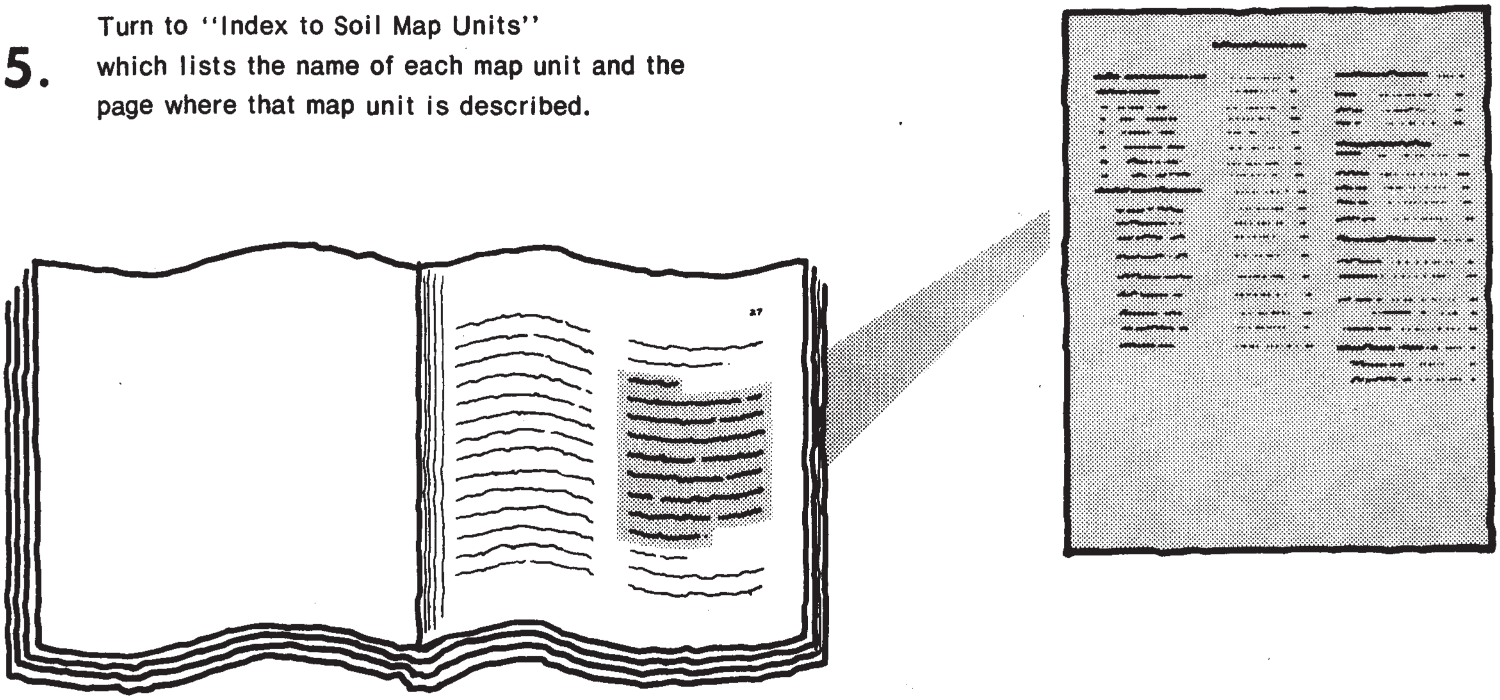

Fa
BaC
WaF
AsB
BaC
Ce
Fa
Ha

4. List the map unit symbols that are in your area.

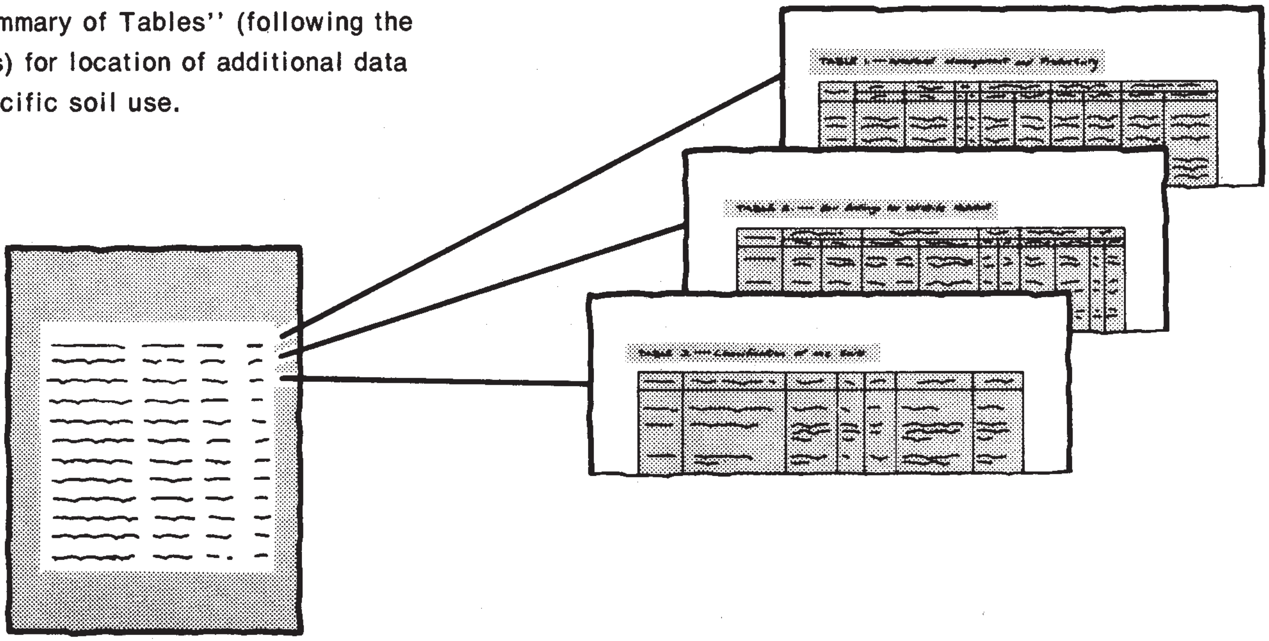

WaF
Fa
BaC
AsB
BaC
Ce
Fa
Ha
Symbols
AsB
BaC
Ce
Fa
Ha
WaF

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1971 to 1975. Soil names and descriptions were approved in May 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. This survey was made by the Soil Conservation Service. It is part of the technical assistance furnished to the Midland Soil Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: The open area is part of the Lenawee-Bowers-Wixom map unit. The wooded area is in the Kingsville-Pipestone-Covert map unit. The white strip extending from the center to the lower right is an area of Aquents.

Contents

Page

Index to soil map units iv
Summary of tables v
Foreword vii
Climate 1
How this survey was made 1
General soil map for broad land use planning 2
  Map unit descriptions 2
    1. Kingsville-Pipestone-Covert 2
    2. Cohoctah-Sloan 2
    3. Belleville-Wixom 3
    4. Wixom-Belleville-Pipestone 3
    5. Lenawee-Bowers-Wixom 4
    6. Parkhill-Londo 4
    7. Ingersoll-Pella 5
  Broad land use considerations 5
Soil maps for detailed planning 6
  Map unit descriptions 6
Use and management of the soils 20
  Crops and pasture 21
    Yields per acre 22
    Capability classes and subclasses 22
  Woodland management and productivity 23
  Windbreaks and environmental plantings 24
  Engineering 24
    Building site development 25
    Sanitary facilities 25
    Construction materials 26
    Water management 27
  Recreation 27
  Wildlife habitat 28
Soil properties 29
  Engineering properties 29
  Physical and chemical properties 30
  Soil and water features 31

Page

Classification of the soils 32
Soil series and morphology 32
  Abscota series 33
  Adrian series 33
  Belleville series 33
  Bowers series 34
  Cohoctah series 34
  Covert series 35
  Ingersoll series 35
  Kingsville series 35
  Kinross series 36
  Lenawee series 36
  Londo series 37
  Menominee series 37
  Oakville series 37
  Parkhill series 38
  Pella series 38
  Pipestone series 38
  Plainfield series 39
  Poseyville series 39
  Sloan series 40
  Wauseon series 40
  Wixom series 40
Formation of the soils 41
  Factors of soil formation 41
    Parent material 41
    Plant and animal life 42
    Climate 42
    Relief 42
    Time 42
  Genesis and morphology 42
References 43
Glossary 43
Illustrations 49
Tables 63

Issued April 1979

Index to soil map units

Page

AbB—Absscota loamy sand, 0 to 6 percent slopes 6
Ad—Adrian muck 7
AeB—Aquents 7
Be—Belleville loamy sand 7
BoB—Bowers silt loam, 0 to 3 percent slopes 8
Ch—Cohoctah fine sandy loam, gravelly substratum 8
CoB—Covert sand, 0 to 6 percent slopes 9
CsB—Covert sand, loamy substratum, 0 to 6 percent slopes 9
InB—Ingersoll silt loam, 0 to 3 percent slopes 10
Kg—Kingsville loamy fine sand 10
Kn—Kinross mucky sand 11
Le—Lenawee silty clay loam 11
LrB—Lenawee-Wixom complex, 0 to 4 percent slopes 12
LxA—Londo loam, 0 to 3 percent slopes 12
MeB—Menominee sand, 2 to 6 percent slopes 13

Page

OaB—Oakville fine sand, 0 to 6 percent slopes 13
Pa—Parkhill loam 14
Pe—Pella silt loam 14
PsB—Pipestone sand, 0 to 3 percent slopes 15
PtB—Pipestone sand, loamy substratum, 0 to 3 percent slopes 15
PuB—Pipestone-Oakville-Urban land complex, 0 to 6 percent slopes 16
PwB—Plainfield sand, 0 to 6 percent slopes 17
PxB—Poseyville-Londo complex, 0 to 4 percent slopes 17
Sz—Sloan loam 18
Ur—Urban land 18
Wa—Wauseon sandy loam 18
WxB—Wixom loamy sand, 0 to 3 percent slopes 19
WzB—Wixom-Belleville-Urban land complex, 0 to 3 percent slopes 19

Summary of Tables

Page

Acreage and proportionate extent of the soils (Table 4) 66

Acres. Percent.

Building site development (Table 9) 76

Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets.

Capability classes and subclasses (Table 6) 68

Class. Total acreage. Major management concerns (Subclass)—Erosion (e), Wetness (w), Soil problem (s), Climate (c).

Classification of the soils (Table 18) 98

Soil name. Family or higher taxonomic class.

Construction materials (Table 11) 82

Roadfill. Sand. Gravel. Topsoil.

Engineering properties and classifications (Table 15) 90

Depth. USDA texture. Classification—Unified, AASHTO. Fragments greater than 3 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.

Freeze dates in spring and fall (Table 2) 65

Probability. Temperature.

Growing season length (Table 3) 65

Probability. Daily minimum temperature during growing season.

Physical and chemical properties of soils (Table 16) 94

Depth. Permeability. Available water capacity. Soil reaction. Shrink-swell potential. Erosion factors—K, T. Wind erodibility group.

Recreational development (Table 13) 86

Camp areas. Picnic areas. Playgrounds. Paths and trails.

Sanitary facilities (Table 10) 79

Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.

Soil and water features (Table 17) 96

Hydrologic group. Flooding—Frequency, Duration, Months. High water table—Depth, Kind, Months. Subsidence—Initial, Total. Potential frost action. Risk of corrosion—Uncoated steel, Concrete.

Summary of Tables—Continued

Page

Temperature and precipitation data (Table 1)........ 64

Month. Temperature—Average daily maximum, Average daily minimum, Average, Average number of growing degree days. Precipitation—Average, Average number of days with 0.10 inch or more, Average snowfall.

Water management (Table 12)........ 84

Pond reservoir areas. Embankments, dikes, and levees. Aquifer-fed excavated ponds. Drainage. Irrigation. Grassed waterways.

Wildlife habitat potentials (Table 14)........ 88

Potential for habitat elements—Grain and seed crops, Grasses and legumes, Wild herbaceous plants, Hardwood trees, Coniferous plants, Wetland plants, Shallow water areas. Potential as habitat for—Openland wildlife, Woodland wildlife, Wetland wildlife.

Windbreaks and environmental plantings (Table 8)........ 73

Predicted 20-year-average height.

Woodland management and productivity (Table 7)........ 69

Management concerns—Erosion hazard, Equipment limitation, Seedling mortality, Windthrow hazard, Plant competition. Potential productivity—Common trees, Site index. Trees to plant.

Yields per acre of crops (Table 5)........ 67

Corn. Corn silage. Winter wheat. Oats. Soybeans. Grass-legume hay. Sugar beets.

Foreword

The Soil Survey of Midland County, Michigan contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

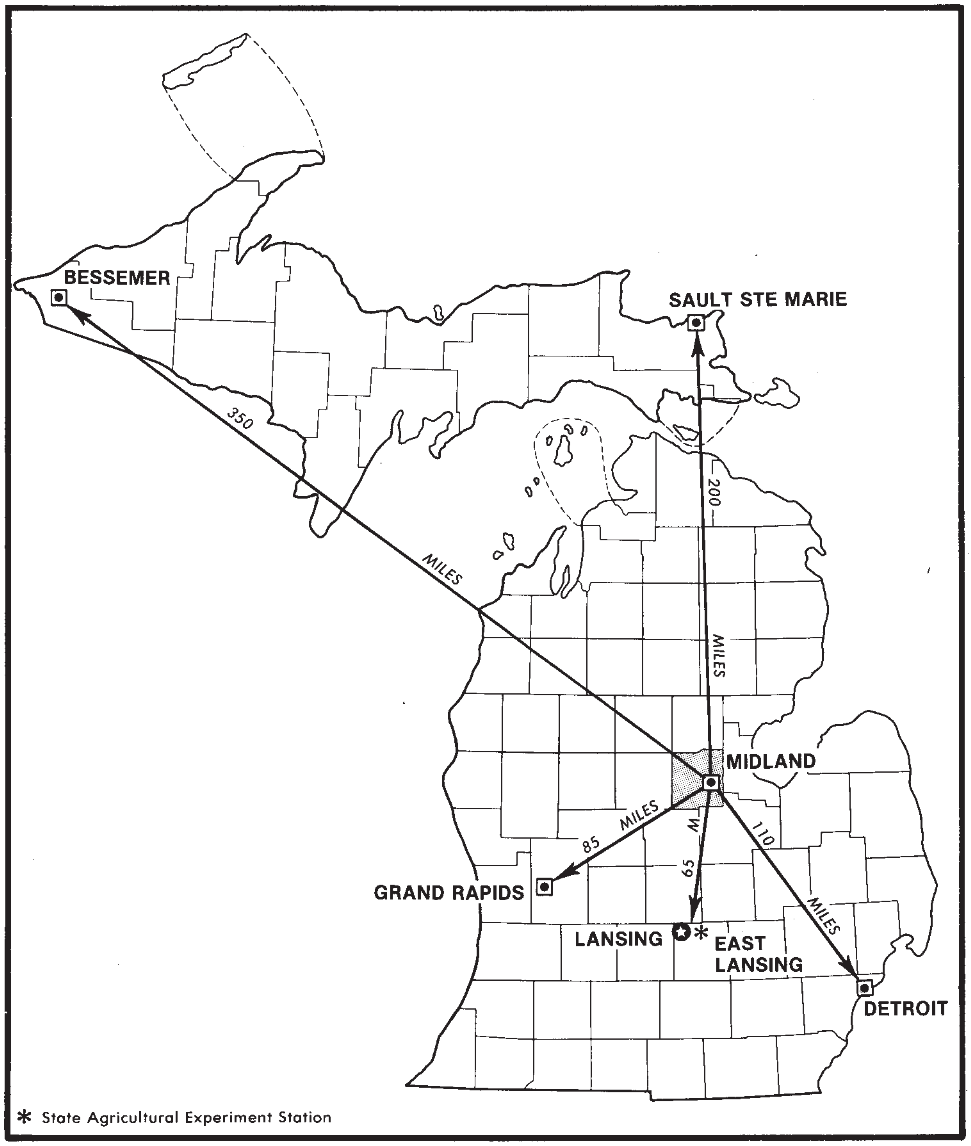
Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Arthur H. Cratty

Arthur H. Cratty
State Conservationist
Soil Conservation Service


BESSEMER
SAULT STE MARIE
350 MILES
200 MILES
MIDLAND
85 MILES
65 MI
110 MILES
GRAND RAPIDS
LANSING
* EAST LANSING
DETROIT
* State Agricultural Experiment Station

Location of Midland County in Michigan.

SOIL SURVEY OF MIDLAND COUNTY, MICHIGAN

By Dennis E. Hutchison, Soil Conservation Service

**Fieldwork by Joseph R. Dumont, James E. Feenstra, Dennis E. Hutchison,
Wesley K. Mettert, Ronald W. Olson, and Therman E. Sanders,
Soil Conservation Service**

United States Department of Agriculture, Soil Conservation Service

MIDLAND COUNTY is in the east-central part of the lower peninsula of Michigan (see facing page). It is bounded on the north by Gladwin County, on the east by Bay and Saginaw Counties, on the south by Saginaw and Gratiot Counties, and on the west by Isabella County. The city of Midland is the county seat and the main commercial center. The total area of Midland County is about 332,800 acres, or 520 square miles.

The main employer in the county is the chemical industry. Farming is another major industry. Corn, beans, wheat, oats, and sugar beets are the main crops. Small industries are located throughout the county.

Climate

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Midland for the period 1946 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 25.1 degrees F, and the average daily minimum temperature is 17.9 degrees. The lowest temperature on record, which occurred at Midland on February 10, 1912, is -30 degrees. In summer the average temperature is 69.5 degrees, and the average daily maximum temperature is 80.8 degrees. The highest recorded temperature, which occurred on July 24, 1934, is 106 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 17.0 inches, or 58 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 13.7 inches. The heaviest 1-day rainfall during the period of record was 4.31 inches at Midland on July 15, 1932. Thunderstorms occur on about 33 days each year, and most occur in June, July, and August.

Average seasonal snowfall is 38.2 inches. The greatest snow depth at any one time during the period of record was 28 inches. On the average, 81 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon, as recorded at Flint, Michigan, the nearest station, is about 62 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The prevailing wind is from the southwest. Average windspeed is highest, 12.1 miles per hour, in March.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Map unit descriptions

1. Kingsville-Pipestone-Covert

Nearly level and gently sloping, poorly drained to moderately well drained soils that have a sandy subsoil or upper substratum; formed in outwash or glacial lake deposits

Areas of this map unit are old glacial lakebeds, beach ridges, and outwash plains. Some are at the same elevation as the adjacent till plains. Some are higher.

This map unit occupies about 45 percent of the county. About 30 percent of the unit is Kingsville and similar soils, 20 percent is Pipestone and similar soils, 15 percent is Covert and similar soils, and the remaining 35 percent is soils of minor extent.

In most places Kingsville soils are lower in elevation than Pipestone and Covert soils. They are in broad flat areas and drainageways. Generally Pipestone and Covert soils occupy the slightly higher broad flat areas and the narrow convex ridgetops and side slopes. All have rapid permeability, a sandy surface layer, and a seasonal high water table.

Kingsville soils are nearly level and poorly drained. The surface layer is very dark gray loamy fine sand about 6 inches thick. The substratum to a depth of about 60 inches is multicolored fine sand.

Pipestone soils are nearly level or gently sloping and somewhat poorly drained. The surface layer is black and grayish brown sand about 6 inches thick. The subsoil is about 18 inches thick. The upper part is yellowish brown, very friable sand. The lower part and the substratum to a depth of about 60 inches are multicolored loose sand.

Covert soils are nearly level or gently sloping and moderately well drained. The surface layer is black and light brownish gray sand about 5 inches thick. The subsoil is about 23 inches thick. The upper part is dark brown and strong brown, very friable sand. The lower part and the substratum to a depth of about 60 inches are multicolored loose sand.

Minor in this unit are the excessively drained Plainfield soils and the moderately well drained Oakville soils. Oakville soils formed in sand. They occupy the same kind of landscape position as Covert soils. Plainfield soils occupy the highest positions, the low knolls and convex ridges.

This map unit is mainly woodland and idle grassland. Wetness is the main limitation. Ponding is common in the lowest areas. Soil blowing is a problem in cultivated areas.

Wetness is such a severe limitation and so difficult to overcome that the potential is poor for farming, recreation, and wildlife and for residential and other engineering uses. The potential is fair for woodland.

2. Cohoctah-Sloan

Nearly level, poorly drained and very poorly drained soils that have a loamy subsoil or upper substratum; formed in loamy or sandy and gravelly alluvial deposits

Areas of this map unit are flood plains that are lower than the surrounding land.

This map unit makes up about 1 percent of the county. About 40 percent of the unit is Cohoctah and similar soils, 30 percent is Sloan and similar soils, and the remaining 30 percent is soils of minor extent (fig. 1).

In most places Cohoctah soils are slightly higher in elevation than Sloan soils. They are in nearly level alluvial areas. Generally Sloan soils are in slightly lower areas and drainageways. All have a loamy surface layer and a seasonal high water table. Permeability is moderately rapid in the upper part of Cohoctah soils and very rapid below. It is moderately slow in Sloan soils.

Cohoctah soils are nearly level and poorly drained or very poorly drained. The surface layer is very dark gray fine sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is multicolored fine sandy loam, gravelly sand, and gravelly loamy sand.

Sloan soils are nearly level and very poorly drained. The surface layer is very dark brown loam about 12 inches thick. The dominantly grayish subsoil is about 28 inches thick. The upper part is friable loam, and the lower part is firm clay loam. The calcareous substratum to a depth of about 60 inches is dominantly grayish sandy loam and silty clay loam.

Minor in this map unit are the moderately well drained Abscota soils. Abscota soils are sandy throughout. They occupy a higher position on the landscape than Cohoctah soils.

This map unit is mainly farmland, recreation land, and woodland. On most of the farmland drainage has been improved. Flooding and ponding for long periods are common.

This map unit has poor potential for cultivated farm crops. Flooding is such a hazard and wetness such a severe limitation and so difficult to overcome that the potential is poor for residential and other engineering uses. The potential is poor for recreation, fair for woodland, and good for wildlife uses.

3. Belleville-Wixom

Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a sandy and loamy subsoil or a sandy upper substratum; formed in glaciofluvial material over till or glacial lake deposits

Areas of this map unit are old glacial lakebeds and till plains that are lower than surrounding beach ridges and outwash plains.

This map unit occupies about 12 percent of the county. About 40 percent of the unit is Belleville and similar soils, 30 percent is Wixom and similar soils, and the remaining 30 percent is soils of minor extent.

In most places Belleville soils are lower in elevation than Wixom soils. They are in broad flat areas and drainageways. Generally Wixom soils occupy the slightly higher flat areas and the low knolls and ridges. Permeability in both soils is rapid over moderately slow. Both have a sandy surface layer and a seasonal high water table.

Belleville soils are nearly level and poorly drained or very poorly drained. The surface layer is black loamy sand about 8 inches thick. The subsurface layer is very dark grayish brown sand about 5 inches thick. The substratum to a depth of about 60 inches is pale brown and grayish brown sand in the upper part and grayish brown silty clay loam in the lower part.

Wixom soils are nearly level or gently sloping and somewhat poorly drained. The surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is grayish brown fine sand about 5 inches thick. The mottled subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable fine sand; the next part is pale brown, very friable fine sand; and the lower part is brown, firm sandy clay loam. The substratum to a depth of about 60 inches is reddish brown, firm silty clay loam.

Minor in this unit are the poorly drained and very poorly drained Lenawee soils and the somewhat poorly drained Pipestone soils. Lenawee soils are loamy or clayey throughout. Like Belleville soils, they occupy the low, flat, or depressional areas. Pipestone soils occupy a higher position on the landscape, generally the low, gently sloping ridges.

This map unit is mainly woodland, but many areas are farmland or idle grassland. Wetness is the main limitation. Flooding for long periods is common in the lower areas. Soil blowing also is a hazard in intensively cultivated areas.

If adequately drained, this map unit has fair potential for cultivated farm crops. Wetness is such a severe limitation and so difficult to overcome that the potential is poor for residential and other engineering uses. The potential is poor for recreational development and fair for woodland development.

4. Wixom-Belleville-Pipestone

Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a sandy or loamy subsoil or a sandy upper substratum; formed in glaciofluvial material over till and glacial lake deposits

Areas of this map unit are old glacial lakebeds, till plains, and outwash plains. They occupy the lower parts of the outwash plains and the higher parts of the till and lake plains.

This map unit occupies about 12 percent of the county. About 35 percent of the unit is Wixom and similar soils, 20 percent is Belleville and similar soils, 10 percent is Pipestone and similar soils that have a loamy substratum, and the remaining 35 percent is soils of minor extent.

In most places Wixom soils are higher in elevation than Belleville soils but lower in elevation than the Pipestone loamy substratum soils. They are on flat areas and low knolls and ridges. Belleville soils occupy the slightly lower broad flat areas and the drainageways. The Pipestone loamy substratum soils are on the slightly higher broad flat areas, the narrow convex ridgetops, and the side slopes. All have a sandy surface layer and a seasonal high water table. Permeability is rapid over moderately slow or slow.

Wixom soils are nearly level or gently sloping and somewhat poorly drained. The surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is grayish brown fine sand about 5 inches thick. The mottled subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable fine sand; the next part is pale brown, very friable fine sand; and the lower part is brown, firm sandy clay loam. The substratum to a depth of about 60 inches is reddish brown, firm silty clay loam.

Belleville soils are nearly level and poorly drained or very poorly drained. The surface layer is black loamy sand about 8 inches thick. The subsurface layer is very dark grayish brown sand about 15 inches thick. The substratum to a depth of about 60 inches is pale brown and grayish brown sand in the upper part and grayish brown silty clay loam in the lower part.

Pipestone soils are nearly level or gently sloping and somewhat poorly drained. The surface layer is very dark gray sand about 8 inches thick. The subsurface layer is grayish brown, loose sand about 2 inches thick. The subsoil is multicolored, very friable sand about 19 inches thick. The substratum to a depth of about 52 inches is multicolored loose sand. To a depth of about 60 inches, it is reddish gray, firm clay loam.

Minor in this unit are the poorly drained or very poorly drained Parkhill soils and the poorly drained Kingsville soils. Parkhill soils are in the same position on the landscape as Belleville soils but are loamy throughout. Kingsville soils, also in the same position as Belleville soils, are sandy throughout.

This map unit is used mainly for cultivated crops, but many areas are woodland. Wetness is the main limitation. Soil blowing is a problem in cultivated areas. Ponding occurs during the wet season.

If adequately drained, this unit has fair potential for cultivated farm crops and fair to poor potential for pasture. Potential is fair for woodland. Wetness is such a severe limitation and so difficult to overcome that the potential is poor for residential, recreational, and most other engineering uses.

5. Lenawee-Bowers-Wixom

Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a loamy and clayey subsoil or a sandy and loamy subsoil; formed in glaciolacustrine and till deposits

Areas of this map unit are old glacial lakebeds and till plains that are lower than surrounding beach ridges and outwash plains.

This map unit occupies about 13 percent of the county. About 35 percent of the unit is Lenawee and similar soils, 20 percent is Bowers and similar soils, 15 percent is Wixom and similar soils, and the remaining 30 percent is soils of minor extent.

In most places Lenawee soils are lower in elevation than Bowers and Wixom soils. They are in broad flat areas and drainageways. Bowers soils are in the slightly higher broad flat areas. Wixom soils occupy the slightly higher flat areas and the low knolls and ridges. All have a seasonal high water table.

Lenawee soils are nearly level and poorly drained and very poorly drained. The surface layer is black, firm silty clay loam about 9 inches thick. The mottled subsoil is about 31 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is light brownish gray, firm silty clay; and the lower part is grayish brown, very firm silty clay. The substratum to a depth of about 60 inches is multicolored, very firm, calcareous silty clay.

Bowers soils are nearly level to gently sloping and somewhat poorly drained. The surface layer is dark yellowish brown silt loam about 9 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, friable silty clay loam, and the lower part is brown, firm silty clay. The substratum to a depth of about 55 inches is brown and strong brown, massive, calcareous silty clay. Below 55 inches, it is loose stratified silt and very fine sand.

Wixom soils are nearly level or gently sloping. The surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is grayish brown fine sand about 5 inches thick. The subsoil is mottled and about 20 inches thick. The upper part is dark yellowish brown fine sand; the next part is pale brown fine sand; and the lower part is brown sandy clay loam. The substratum to a depth of about 60 inches is reddish brown silty clay loam.

Minor in this unit are the poorly drained or very poorly drained Belleville soils and the somewhat poorly drained Pipestone loamy substratum soils. Belleville soils are in the same position on the landscape as Lenawee soils but have 20 to 40 inches of sand over loamy material. The Pipestone loamy substratum soils are on the tops of low knolls and ridges.

This map unit is used mainly for cultivated crops, but some areas are pasture or woodland. Most of the farmland has been drained. Wetness is the main limitation. Soil blowing is a problem in cultivated areas.

If adequately drained, this unit has good potential for cultivated farm crops. The potential is fair to good for woodland. Wetness is such a severe limitation and so difficult to overcome that the potential is poor for residential, recreational, and most other engineering uses.

6. Parkhill-Londo

Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a loamy subsoil; formed in glacial till deposits

Areas of this map unit are till plains that are lower than surrounding beach ridges and outwash plains.

This map unit occupies about 14 percent of the county. About 40 percent of the unit is Parkhill and similar soils, 25 percent is Londo and similar soils, and the remaining 35 percent is soils of minor extent (fig. 2).

In most places Parkhill soils are lower in elevation than Londo soils. They are in broad low areas, depressions, and drainageways and along the base of ridges. Londo soils are in slightly higher broad flat areas. Both have a loamy surface layer and a seasonal high water table.

Parkhill soils are nearly level and very poorly drained or poorly drained. The surface layer is very dark brown loam about 8 inches thick. The subsoil is grayish brown and gray, friable loam about 17 inches thick. The substratum to a depth of about 60 inches is gray and grayish brown, calcareous loam.

Londo soils are nearly level or gently sloping and somewhat poorly drained. The surface layer is very dark grayish brown loam about 9 inches thick. The mottled, firm subsoil is about 10 inches thick. The upper part is brown and pale brown loam, and the lower part is dark yellowish brown clay loam. The substratum to a depth of about 60 inches is gray, mottled, firm calcareous loam.

Minor in this unit are the poorly drained or very poorly drained Belleville soils and the somewhat poorly drained Poseyville and Wixom soils. Belleville soils are in the same position on the landscape as Parkhill soils but have 20 to 40 inches of sandy material over the loamy material. Poseyville and Wixom soils are slightly higher, on low knolls and ridges, and have 15 to 40 inches of sandy material over the loamy material.

This map unit is used mainly for cultivated crops, but some areas are woodland. Most of the farmland has been drained. Wetness is the main limitation. Soil blowing is a problem in cultivated areas.

If adequately drained, this unit has good potential for cultivated farm crops, pasture, and woodland. Potential is good to fair for wildlife. Wetness is such a severe limitation and so difficult to overcome that the potential is poor for residential and most engineering uses. The potential is poor for recreational development.

7. Ingersoll-Pella

Nearly level and gently sloping, poorly drained and somewhat poorly drained soils that have a loamy subsoil; formed in glaciolacustrine and glaciofluvial deposits

Areas of this map unit are old glacial lakebeds and outwash plains. They are lower than the surrounding beach ridges.

This map unit occupies about 3 percent of the county. About 40 percent of the unit is Ingersoll and similar soils, 30 percent is Pella and similar soils, and the remaining 30 percent is soils of minor extent (fig. 3).

In most places Ingersoll soils are higher in elevation than Pella soils. They are in broad flat areas. Pella soils are in the slightly lower flat areas and drainageways. Both have moderate permeability, a loamy surface layer, and a seasonal high water table.

Ingersoll soils are nearly level or gently sloping and somewhat poorly drained. The surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is mottled, brown, friable silt loam about 3 inches thick. The substratum to a depth of about 60 inches is multicolored, friable, calcareous, stratified silt loam, very fine sand, and silty clay loam.

Pella soils are nearly level and poorly drained. The surface layer is black silt loam about 12 inches thick. The subsoil is olive gray silt loam and silty clay loam about 8 inches thick. The substratum is about 40 inches thick. The upper part is olive, friable silty clay loam, and the lower part is grayish brown, friable silt and very fine sand.

Minor in this unit are the somewhat poorly drained Poseyville and Wixom soils and the poorly drained or very poorly drained Lenawee soils. Poseyville and Wixom soils have a sandy surface layer and upper subsoil. They occupy landscape positions similar to those of Ingersoll soils. Lenawee soils have a loamy subsoil. They occupy positions similar to those of Pella soils.

This map unit is used mainly for farming, but some areas are woodland or idle grassland. Most of the farmland has been drained. Wetness is the main limitation. Flooding and ponding are common in the low areas.

If adequately drained, this unit has good potential for cultivated farm crops. Wetness is such a severe limitation and so difficult to overcome that the potential is poor for residential and most engineering uses. The potential is poor for recreation, fair for woodland, and good for wildlife.

Broad land use considerations

Deciding what land should be used for urban development is an important issue in the county. Each year a considerable acreage is developed for urban use in Midland Township and in other areas throughout the county. About 20,000 acres, or about 6 percent of the county, is urban or built-up land. The general soil map can help in broad planning, but it should not be used in selecting a site for a specific use.

All map units on the general soil map have severe limitations for most urban uses. No large areas can be developed at low cost. In addition, urban development is costly on the soft, wet, organic soils that are included in many of the map units.

The Cohoctah-Sloan unit is an alluvial area where flooding, ponding, and an almost continuous high water table are very severe problems that are very costly to overcome.

The Kingsville-Pipestone-Covert unit, although poorly suited to development, is the least costly to develop for urban use. The moderately well drained Covert soils and the included moderately well drained and excessively drained Oakville and Plainfield soils have low shrink-swell potential and low frost heave potential.

In some areas the soils have good potential for farming but poor potential for nonfarm use. See, for example, map units 5 (fig. 4), 6, and 7 on the general soil map. The dominant soils are Wixom, Ingersoll, Pella, Lenawee, Bowers, Parkhill, and Londo. Wetness is a limitation. Adequate drainage is needed. Most areas used for farm crops have been drained.

Some soils have fair potential for farming but poor potential for nonfarm use. These soils are in map units 3 and 4. Wetness is the main limitation. Most areas farmed in these units have tile drainage or open ditch drainage.

On the soils in map units 1, 3, and 4, blowing is a problem. All are sandy.

Map units 1, 3, and 4 (fig. 5) in this county have fair potential for woodland. Trees on the better drained sandy soils of these units are suitable for pulp or low grade lumber. Map units 2, 5, 6, and 7 have good or fair potential for woodland. The wetness, however, causes slow growth, low survival, and poor regeneration of seedlings.

Most of the map units have poor potential for recreational development. Wetness (fig. 6) is the main limitation. On the sandy soils in units 1, 3, and 4, blowing is a hazard. On these soils, fertility is low. Consequently, a grassy plant cover dies out readily under intensive foot traffic.

The lower, wetter, undrained areas in all map units are mostly wooded or brushy. Some are in wetland grasses, reeds, and sedges. The wooded areas and the wetlands provide habitat for many important species of wildlife.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Ingersoll series, for example, was named for the township of Ingersoll in Midland County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Covert sand, loamy substratum, 0 to 6 percent slopes, is one of several phases within the Covert series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Lenawee-Wixom complex, 0 to 4 percent slopes, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Some survey areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Urban land is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Map unit descriptions

AbB—Abscota loamy sand, 0 to 6 percent slopes. This nearly level to gently sloping, moderately well drained soil is on high flood plains. It is subject to occasional flooding. Escarpments are common between the uplands and the flood plains. Individual areas of this soil are irregular in shape and range from 5 to 125 acres.

Typically, the surface layer is very dark grayish brown loamy sand about 5 inches thick. The subsoil, about 17 inches thick, is yellowish brown sand. The substratum to a depth of about 60 inches is yellowish brown and light yellowish brown sand. In some places the subsoil contains more clay than is typical. In places both the subsoil and the substratum are stratified with thin bands of loamy material.

Included with this soil in mapping are small areas of somewhat poorly drained loamy soils and poorly drained or very poorly drained Cohoctah soils. These included soils are in shallow depressions and drainageways and near the base of adjacent escarpments. They make up 2 to 15 percent of the unit.

Permeability is rapid. Surface runoff is slow. Available water capacity is low. A seasonal high water table fluctuates between depths of 2 and 5 feet.

Most of the acreage is woodland. The potential is fair for trees. It is fair for cultivated crops, hay, and pasture and poor to fair for recreation and engineering uses.

This soil is suited to cultivated crops. The most difficult hazard to overcome is the flooding early in spring. Flooding greatly reduces the yield of winter wheat and legume hay crops. Soil blowing and droughtiness can be controlled by cover crops, minimum tillage, and irrigation. Returning crop residue and adding fertilizer increase production.

The use of the soil as pastureland or hayland is restricted by flooding, soil blowing, and droughtiness. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and the soil in good condition.

This soil is suited to trees. Tree seeds, cuttings, and seedlings survive and grow better if competing vegetation is controlled. The only hazard of concern in planting or harvesting trees is the flooding.

Because of the flooding, this soil is poorly suited to onsite sanitary facilities and building site development. Flooding can be prevented only by installing expensive flood control structures.

Capability subclass IVs.

Ad—Adrian muck. This nearly level, very poorly drained soil is in broad, slightly depressional areas and drainageways. It is subject to frequent flooding. Individual areas are narrow or irregular in shape and range from 2 to 270 acres.

Typically, the surface tier is black muck about 12 inches thick. The subsurface tier is very dark gray muck about 12 inches thick. The substratum to a depth of about 60 inches is very dark brown and dark grayish brown fine sand. In some places it contains a loamy or clayey layer. In some places the organic layer is less than 16 inches thick and in others it is more than 50 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Pipestone soils and poorly drained Kingsville soils. The Pipestone soils are on low knolls and ridges. The Kingsville soils lack organic layers. These included areas make up 2 to 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy substratum. Available water capacity is high. Surface runoff is very slow. The seasonal high water table is within a depth of 1 foot. Potential frost action is high. If drained, the soil is subject to blowing.

Most of the acreage is in idle wetland vegetation. The potential is good for wetland wildlife and poor for most other uses.

If adequately drained, this soil is suited to cropland, pasture, or woodland. Tile or open ditch drainage is needed. These depressional areas have very few drainage outlets. An extensive pumping system or ditches or both are needed. If drained, the soil is subject to blowing. Minimum tillage, stripcropping, and winter cover crops reduce the hazard of erosion.

This soil is generally not suited to sanitary facilities and building site development because of wetness and flooding.

Capability subclass Vw.

AeB—Aquents. This nearly level or gently sloping wet soil is in depressions and dugouts. It is subject to frequent flooding. Individual areas are irregular in shape and range from 3 to 150 acres.

Typically, the profile is sandy or loamy material that has been exposed by excavation. Most other soil properties are variable.

Included with this soil in mapping are small better drained areas of loamy or sandy material that have been formed by piling spoil or by cutting into and disturbing high knolls and ridges. Small gravel or borrow pits are also included. The included areas make up 5 to 20 percent of the unit.

Most of the acreage is idle and lacks a plant cover. Suitability in land use varies greatly. The major hazards and management problems for all major land uses and the practices needed to help overcome them should be determined by onsite investigation.

Not assigned to a capability subclass.

Be—Belleville loamy sand. This nearly level, poorly drained and very poorly drained soil is in broad flat areas and drainageways. It is subject to frequent flooding. Individual areas of this soil are irregular in shape and range from 2 to 3,700 acres.

Typically, the surface layer is black loamy sand about 8 inches thick. The subsurface layer is very dark grayish brown sand about 5 inches thick. The substratum to a depth of 60 inches is pale brown and grayish brown sand in the upper part and grayish brown silty clay loam in the lower part. In some places the lower part is stratified silt loam and very fine sand. In others, it contains more clay than is typical.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone loamy substratum soils and Wixom soils and the poorly drained and very poorly drained Parkhill soils. The Pipestone loamy substratum soils and Wixom soils occupy narrow ridges and slightly convex areas. Parkhill soils have a loamy texture in the solum and substratum. These included areas make up 2 to 10 percent of the unit.

Permeability is rapid in the sandy material and moderately slow in the loamy material. Surface runoff is very slow or ponded. The available water capacity is moderate. The surface layer is friable and is easily tilled throughout a fairly wide range of moisture content. The shrink-swell potential is low in the sandy material and moderate in the loamy material. Potential frost action is high. A seasonal high water table is within a depth of 1 foot.

Most of the acreage is woodland. Some is farmed. The potential is poor to fair for cultivated crops, hay, pasture, and trees. It is poor for most engineering uses.

If adequately drained, this soil is suited to crops and pasture. Open ditch and tile drainage can be used to lower the high water table. The tile should be covered with a suitable blinding material to prevent fine sand from filling the tile line. If the soil is cultivated, soil blowing is a hazard. Minimum tillage, cover crops, and windbreaks reduce the hazard. Returning crop residue improves fertility.

The use of this soil as pastureland is limited mainly by the high water table. Overgrazing or grazing when the soil is wet results in poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Site preparation, prescribed burning, spraying, cutting, or girdling is needed. The use of equipment is severely limited during the wet season. The windthrow hazard is moderate.

The soil is poorly suited to building site development and onsite sanitary facilities. Artificial drainage is needed to lower the seasonal high water table. Connecting sewage disposal facilities to a public sewerage system should be considered.

Capability subclass IIIw.

BoB—Bowers silt loam, 0 to 3 percent slopes. This nearly level to gently sloping, somewhat poorly drained soil is in broad flat areas. Individual areas are irregular in shape and range from 2 to 500 acres.

Typically, the surface layer is dark yellowish brown silt loam about 9 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, friable silty clay loam, and the lower part is brown, firm silty clay. To a depth of about 55 inches the substratum is brown and strong brown, massive, calcareous silty clay. Below 55 inches, it is loose stratified silt and very fine sand.

Included with this soil in mapping are small areas of the sandy, somewhat poorly drained Wixom soils on low knolls and ridges. Also included are areas of the poorly drained and very poorly drained Lenawee soils in low shallow depressions. These included areas make up 2 to 10 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Surface runoff is very slow. A seasonal high water table is between depths of 1 and 2 feet. Shrink swell is moderate. Frost action is high. The surface layer is friable and is easily tilled throughout a fairly wide range of moisture content, but it tends to crust or puddle after hard rains, especially in areas where the plow layer contains subsoil material.

Most of the acreage is farmed. The potential is good for cultivated crops, hay, pasture, and woodland. It is poor for engineering and fair to good for wildlife.

This soil is suited to corn, soybeans, small grain, sugar beets, and grass-legume hay or pasture. If it is used for cultivated crops, soil blowing is a hazard. Minimum tillage and winter cover crops help to prevent excessive soil loss. Artificial drainage is needed for highest yields. Regular additions of organic matter improve fertility, reduce crusting, and increase water infiltration.

This soil is suited to pastureland. Grazing when the soil is wet, however, results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the soil and pasture in good condition.

This soil is suited to trees. Small areas remain in native hardwoods. Equipment is limited during wet seasons. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. The hazards of erosion, windthrow, and seedling mortality are slight.

This soil is poorly suited to building site development and onsite sanitary facilities. It lacks sufficient strength and stability to support foundations and roads. The major problems are wetness, low strength, and slow percolation. Artificial drainage is needed. Connecting sewage disposal facilities to a public sewerage system should be considered. The low strength can be partially overcome by replacing the base material with suitable material and by installing footing drains around foundations.

Capability subclass IIw.

Ch—Cohoctah fine sandy loam, gravelly substratum. This nearly level, poorly drained and very poorly drained soil is on bottom land. It is subject to frequent flooding. Individual areas are irregular in shape and range from 2 to 440 acres. On the upland side, they are bordered by escarpments.

Typically, the surface layer is very dark gray fine sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is multicolored fine sandy loam, gravelly sand, and gravelly loamy sand.

Included with this soil in mapping are small areas of moderately well drained Abscota soils on low knolls, ridges, and flats. Also included are somewhat poorly drained loamy soils in the slightly higher nearly level areas and very poorly drained Sloan soils in the depressions and drainageways. These included areas make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the loamy material and very rapid in the gravelly sand. Available water capacity is moderate. Surface runoff is very slow or ponded. Potential frost action is high. A seasonal high water table is within a depth of 1 foot.

Most of the acreage is native woodland. Potential is poor for cropland, hayland, grassland, and recreation facilities. It is poor to fair for woodland and poor for engineering uses.

This soil is not suited to cultivated crops because of the hazards of flooding and soil blowing and the wetness. Because flooding is common and prolonged, it is nearly impossible to overcome.

The use of this soil for hay and pasture depends on the degree of flood control and drainage improvement. Selection of wetland plant species, proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and the soil in good condition.

This soil is suited to trees and shrubs. Most of the acreage is in native species. Flooding and wetness are major problems. Equipment limitations, seedling mortality, windthrow hazard, and plant competition are severe. Removing obstructions from the natural drainageways reduces the excessive wetness. Cutting or girdling of undesirable species reduces plant competition. There is little or no erosion hazard in fully stocked woodland.

This soil is generally not suited to sanitary facilities and building site development because of wetness and flooding.

Capability subclass Vw.

CoB—Covert sand, 0 to 6 percent slopes. This nearly level to gently sloping, moderately well drained soil occupies broad, flat areas, narrow ridgetops, and low knolls. Individual areas are narrow or irregular in shape and range from 3 to 600 acres.

Typically, the surface layer is black and light brownish gray sand about 5 inches thick. The subsoil is about 23 inches thick. The upper part is dark brown and strong brown, very friable sand. The lower part and the substratum to a depth of about 60 inches are multicolored, loose sand. In some places no precipitated iron, aluminum, and organic matter have accumulated.

Included with this soil in mapping are small areas of the Covert loamy substratum soils, excessively drained Plainfield soils, somewhat poorly drained Pipestone soils, and poorly drained Kingsville soils. The Covert loamy substratum soil occupies the same kind of position on the landscape as the Covert soil but has a loamy substratum at a depth of 40 to 60 inches. The Plainfield soil is on the highest parts of the ridgetops and knolls. The Pipestone soil is on the foot slopes of the ridges and knolls and on the slightly lower parts of the broad flat areas. The Kingsville soil is in small depressions and drainageways of the broad flat areas. These included areas make up 3 to 20 percent of the unit.

This soil has rapid permeability and low available water capacity. Surface runoff is very slow. A seasonal high water table fluctuates between depths of 1 1/2 and 3 1/2 feet.

Most of the acreage is woodland or idle grassland. Potential is poor for cultivated crops, pasture, and wildlife. It is fair for woodland and fair to poor for recreation and most engineering uses.

This soil is suited to cropland or pasture but is droughty in summer and is subject to soil blowing. Irrigation is needed. Minimum tillage and a winter cover crop reduce the risk of soil blowing.

This soil is suited to woodland, but the droughtiness causes seedling mortality. Planting drought resistant varieties, mulching, and irrigating lower the mortality rate. Tree seeds, cuttings, and seedlings survive if competing vegetation is controlled or removed. Site preparation, prescribed burning, or spraying, cutting, or girdling is needed.

This soil is poorly suited to sanitary facilities and dwellings. The seasonal high water table and rapid permeability are severe limitations for onsite waste disposal. The combination of these two properties can cause effluent seepage and result in pollution of ground water supplies. Connecting sewage disposal facilities to a public sewerage system should be considered. The seasonal high water table and saturation cause caving and make excavation difficult. If excavation is necessary, tile drainage and shoring up the walls help to prevent the caving. The seasonal high water table limits other building site development, for example, footings and foundations. Tile drainage or fill is needed. This soil is favorable for local roads or streets.

Capability subclass IVs.

CsB—Covert sand, loamy substratum, 0 to 6 percent slopes. This nearly level to gently sloping, moderately well drained soil occupies flat areas, narrow ridgetops, and low knolls. Individual areas are narrow or irregular in shape and range from 3 to 110 acres.

Typically the surface layer is black sand about 5 inches thick. The subsurface layer is pinkish gray, friable sand about 3 inches thick. The subsoil is about 22 inches thick. The upper part is strong brown and dark brown, friable sand, and the lower part is brownish yellow, very friable sand. The upper part of the substratum, to a depth of about 43 inches, is pale brown and yellowish brown, loose sand. The lower part to a depth of about 60 inches is reddish brown, firm silty clay loam. In some places no precipitated iron, aluminum, and organic matter have accumulated.

Included with this soil in mapping are small areas of the excessively drained Plainfield soils, somewhat poorly drained Pipestone loamy substratum soils, and poorly drained Kingsville soils. The Plainfield soil is on the highest parts of the ridgetops and knolls. The Pipestone loamy substratum soil is on the foot slopes of the ridges and knolls and in the slightly lower parts of the flat areas. The Kingsville soil is in small depressions and drainageways in the flat areas. These included areas make up 3 to 20 percent of the unit.

Permeability is rapid in the sandy material and moderately slow in the loamy material. Available water capacity is moderate. Surface runoff is slow. A seasonal high water table fluctuates between depths of 1 1/2 and 3 1/2 feet.

Most of the acreage is woodland or idle grassland. Potential is poor for cultivated crops, pasture, and wildlife. It is fair for woodland and fair to poor for recreation and most engineering uses.

If adequately drained, this soil is suited to cropland or pasture. It is droughty in summer and is subject to soil blowing. Irrigation is needed. Minimum tillage and a winter cover crop reduce the hazard of soil blowing.

This soil is suited to woodland. Droughtiness causes seedling mortality. Planting drought resistant varieties, mulching, and irrigating can lower the mortality rate. Tree seeds, cuttings, and seedlings survive if competing vegetation is controlled or removed. Site preparation, prescribed burning, or spraying, cutting, or girdling is needed.

This soil is poorly suited to onsite waste disposal, buildings with basements, and lagoons. The seasonal high water table is a severe limitation for onsite waste disposal. The high water table and rapid permeability can cause effluent seepage and result in pollution of ground water supplies. Connecting sewage disposal facilities to a public sewerage system should be considered. The seasonal high water table and saturation cause caving and make excavation difficult. If excavation is necessary, tile drainage and shoring help to control the caving.

Capability subclass IVs.

InB—Ingersoll silt loam, 0 to 3 percent slopes. This nearly level to gently sloping, somewhat poorly drained soil is in broad, flat areas. Individual areas are irregular in shape and range from 2 to 900 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is mottled, brown, friable silt loam about 3 inches thick. The substratum to a depth of about 60 inches is multicolored, friable, calcareous, stratified silt loam, very fine sand, and silty clay loam. In some places, no clay has accumulated in the subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Poseyville soils and poorly drained Pella soils. The Poseyville soil is in the same position on the landscape as the Ingersoll soil but has 16 to 24 inches of sand, loamy sand, and sandy loam over the loamy material. The Pella soil is in shallow depressions and drainageways. These included areas make up 5 to 15 percent of the unit.

This soil has moderate permeability and slow surface runoff. It has a high available water capacity. A seasonal high water table fluctuates between depths of 1 and 2 feet. The surface layer is friable and is easy to till throughout a fairly wide range in moisture content. Potential frost action is high.

Most of the acreage is farmed. Potential is good for cultivated crops, hay, pasture, and trees. It is good for wildlife, poor to fair for recreation, and poor for most engineering uses.

This soil is suited to corn, soybeans, wheat, oats, sugar beets, grass-legume hay, and pasture. The seasonal high water table can be lowered by tile or open ditch drainage. Erosion damage is a hazard if cultivated crops are grown. Minimum tillage, winter cover crops, and grassed waterways reduce the risk of erosion.

Using this soil as pasture is good erosion control. Grazing when the soil is wet causes surface compaction, poor tilth, and excessive runoff. Restricting grazing during wet periods keeps the pasture and the soil in good condition.

This soil is suited to woodland. Equipment should be kept off the site during wet periods. Site preparation should be done in the fall. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Site preparation, prescribed burning, or spraying, cutting, or girdling is needed.

This soil is poorly suited to onsite waste disposal, building site development, and local roads and streets. The seasonal high water table can cause pollution of ground water supplies because of seepage of effluent from onsite waste disposal systems. Connecting sewage disposal facilities to a public sewerage system should be considered. The seasonal high water table makes building site development difficult. Tile or open ditch drainage helps to lower the water table. A suitable base material should be laid when building local roads to prevent frost action damage.

Capability subclass IIw.

Kg—Kingsville loamy fine sand. This nearly level, poorly drained soil is in broad flat areas and drainageways. It is subject to frequent flooding. Individual areas are irregular in shape and range from 3 to 4,000 acres.

Typically, the surface layer is very dark gray loamy fine sand about 6 inches thick. The substratum to a depth of about 60 inches is multicolored fine sand. In places it is loamy or clayey at a depth of 45 to 60 inches. In some areas the subsoil is more acid than is typical, or there is an organic surface layer as much as 16 inches thick. In some areas precipitated iron, aluminum, and organic matter have accumulated.

Included with this soil in mapping are small areas of the moderately well drained Covert soils on knolls and ridges and areas of the somewhat poorly drained Pipestone soils on low knolls and ridges. These included areas make up 5 to 15 percent of the unit.

Permeability is rapid, and surface runoff is very slow. The available water capacity is low. A seasonal high water table is within a depth of 1 foot. Potential frost action is moderate.

Most of the acreage is woodland and idle grassland. Potential is fair to good for wildlife, poor for woodland, cropland, and most engineering uses, and fair for grass, hay, and pasture.

If adequately drained, this soil is suited to cultivated crops. Artificial drainage is needed to lower the high water table (fig. 7). In cultivated areas, soil blowing is a hazard. Field stripcropping, minimum tillage, and winter cover crops help prevent excessive soil loss. Returning crop residue or regularly adding other organic matter improves fertility and increases available water capacity. This soil becomes droughty during the growing season.

This soil is suited to grass pasture or hayland. Wetness is the major problem. Ditch and tile drainage help to control the wetness. Livestock should be fenced away from ditches to help control bank erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but much of the acreage remains in low quality native hardwoods. Wetness is the major problem. Removing obstructions from natural drainageways improves drainage. The windthrow hazard is severe because of the wetness. The equipment limitation is severe. The soil must be dry or frozen for management activities. Seedling mortality is severe. This can be partially overcome by planting on the included areas of Covert or Pipestone soils.

This soil is poorly suited to building site development, local roads and streets, and onsite waste disposal. The major limitations are the wetness (fig. 8) and the rapid percolation rate. Drainage is needed. Connecting sewage disposal facilities to a public sewerage system should be considered. The severe limitations for foundations can be partially overcome by installing footing drains around foundations. Road and street development is also limited by the wetness. Drainage and elevation of roads are needed. Fill and topsoil are needed for successful lawns.

Capability subclass IVw.

Kn—Kinross mucky sand. This nearly level, poorly drained soil is in broad, flat or slightly depressional areas and drainageways. It is subject to frequent flooding. Individual areas are narrow or irregular in shape and range from 3 to 160 acres.

Above the surface layer is 8 inches of black, very friable muck. The surface layer is very dark brown, very friable mucky sand about 3 inches thick. The subsurface layer is dark grayish brown, friable sand about 4 inches thick. The subsoil is multicolored, friable sand about 22 inches thick. The substratum to a depth of about 60 inches is yellowish brown, friable sand. In some places no precipitated iron, aluminum, and organic matter have accumulated. In places the organic surface layer is thicker than is typical, and in places there is a loamy or clayey substratum.

Included with this soil in mapping are small areas of somewhat poorly drained Pipestone soils on low knolls and ridges. These included areas make up 2 to 10 percent of the unit.

Kinross soils have very rapid permeability and low available water capacity. Surface runoff is slow to ponded. A seasonal high water table is within a depth of 1 foot. Potential frost action is moderate. If drained, the soil is subject to blowing.

Most of the acreage is sparsely wooded. Many areas are covered by acid tolerant wetland vegetation. Potential is poor for cultivated crops, pasture, woodland, wildlife, recreation, and most engineering uses.

The soil is not suited to crops. Flooding and the seasonal high water table limit use as pasture or woodland. Artificial drainage is needed. These depressional areas have very few drainage outlets, so that an extensive pumping system or ditches or both are needed. If drained, the soil is subject to blowing.

This soil is generally not suited to building site development, onsite sewage disposal systems, and local roads and streets. The drainage problem is almost impossible to overcome without great expense. The higher, better drained included areas of other soils can be used for development.

Capability subclass VIw.

Le—Lenawee silty clay loam. This nearly level, poorly drained and very poorly drained soil is in broad flat areas and drainageways. It is subject to frequent flooding. Individual areas are irregular in shape and range from 3 to 800 acres.

Typically, the surface layer is black silty clay loam about 9 inches thick. The mottled subsoil is about 31 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is light brownish gray, firm silty clay; and the lower part is grayish brown, very firm silty clay. The substratum to a depth of about 60 inches is multicolored, very firm, calcareous silty clay. In some places the subsoil is more than 45 percent clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Wixom and Bowers soils and the poorly drained or very poorly drained Belleville soils. Wixom and Bowers soils occupy low ridges and slightly convex areas. The Wixom and Belleville soils have a coarser textured solum than Lenawee soils. These included areas make up 5 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is moderate. Surface runoff is very slow or ponded. A seasonal high water table is within a depth of 1 foot. Potential frost action is high.

Most of the acreage is farmed. Potential is good for cultivated crops, hay, and pasture. It is poor for recreational facilities and for most engineering uses.

This soil is suited to corn, soybeans, small grain, and grasses and legumes for hay and pasture. The major problems are wetness and flooding. Artificial drainage helps to overcome these problems. Minimum tillage, winter cover crops, and field crop strips help to prevent soil loss.

This soil is suited to pastureland or hayland. Overgrazing or grazing when the soil is too wet, however, results in surface compaction and poor tilth. Artificial drainage reduces the wetness. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, and many areas remain in native species. Plant competition, seedling mortality, and equipment limitations are severe. Removing or controlling competing vegetation, working during the dry seasons, and removing obstructions from natural drainageways to reduce wetness help to control these problems. Site preparation, prescribed burning, or spraying, cutting, or girdling is needed.

This soil is poorly suited to onsite sanitary facilities and building site development. Wetness and flooding are severe limitations for septic tank absorption fields, sewage lagoons, and landfills. Connecting sewage disposal facilities to a public sewerage system should be considered. Construction of small buildings is limited by wetness and low strength. Local roads need artificial drainage and suitable base material to overcome the problems of wetness and frost action.

Capability subclass IIw.

LrB—Lenawee-Wixom complex, 0 to 4 percent slopes. This map unit consists of nearly level to gently sloping, poorly drained or very poorly drained and somewhat poorly drained soils in broad flat areas and on the intermingled low knolls and discontinuous ridges. Individual areas of this unit range from 28 to 400 acres. Most are dissected by shallow drainageways and depressions. They are 40 to 50 percent Lenawee soils and 30 to 40 percent Wixom soils. The Lenawee soil is in the flat or depressional areas and the drainageways. It is subject to frequent flooding. The Wixom soil occupies the low knolls, low ridges, and slightly convex areas. The areas of the two soils were so intricately mixed or so small in size that it was not practical to map them separately.

Typically, the Lenawee soil has a surface layer of black silty clay loam about 9 inches thick. The mottled subsoil is about 31 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is light brownish gray, firm silty clay; and the lower part is grayish brown, very firm silty clay. The substratum to a depth of about 60 inches is multicolored, very firm, calcareous silty clay. In some places the subsoil is more than 45 percent clay.

Typically, the Wixom soil has a surface layer of very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is grayish brown fine sand about 5 inches thick. The mottled subsoil is about 20 inches thick. The upper part is dark yellowish brown and pale brown, friable fine sand, and the lower part is brown, firm sandy clay loam. The substratum to a depth of about 60 inches is reddish brown, firm silty clay loam. In some areas no precipitated iron, aluminum, and organic matter have accumulated in the subsoil. In places the substratum is more than 35 percent clay.

Included with these soils in mapping and making up 10 to 20 percent of the unit are small areas of the somewhat poorly drained Bowers and Pipestone loamy substratum soils and the poorly drained or very poorly drained Belleville soils. The Bowers soil contains more clay in the subsoil than the Wixom soil. It occupies the high parts of drainageways and the foot slopes of low knolls and ridges. The Pipestone loamy substratum soil is on the tops of low knolls and ridges. The Belleville soil has 20 to 40 inches of sand over loamy material. It is in the same position on the landscape as the Lenawee soil.

Permeability is moderately slow in the Lenawee soil. In the Wixom soil it is rapid in the sandy material and moderately slow in the loamy material. Available water capacity is moderate in both soils. Surface runoff is very slow or ponded on the Lenawee soil and slow on the Wixom soil. The Lenawee soil has high potential frost action. The seasonal high water table is within a depth of 1 foot. The Wixom soil has moderate potential frost action. The seasonal high water table is between 1 and 2 feet. Soil blowing is a hazard on the Wixom soil.

Most of the acreage of this unit is farmed. Potential is good for cultivated crops and good to fair for pasture. It is fair for woodland and poor for most recreational and engineering uses.

This unit is suited to corn, soybeans, and small grain. Artificial drainage helps to overcome the wetness. The risk of soil blowing on the higher sandy spots can be reduced by minimum tillage, field strips, and winter cover crops. Returning crop residue or regularly adding other organic material improves fertility, reduces crusting, and increases water infiltration.

This unit is suited to pasture. Overgrazing or grazing when the soil is too wet, however, results in surface compaction, excessive runoff, and poor tilth. Artificial drainage, proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This unit is suited to trees. A few small areas remain in native woodland. Obstructions should be removed from natural drainageways to reduce the wetness. Heavy equipment should be used only when the soil is dry or frozen. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Site preparation, prescribed burning, or spraying, cutting, or girdling is needed.

This unit is poorly suited to onsite sewage disposal systems, building site development, and local roads and streets. Sanitary facilities are severely limited by wetness, seepage, and frequent, brief flooding. Connecting sewage disposal facilities to a public sewerage system should be considered. Building site development is severely limited by the wetness and flooding. Artificial drainage reduces the wetness.

Capability subclass IIw.

LxA—Londo loam, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is in broad flat areas. Individual areas are irregular in shape and range from 3 to 600 acres.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The mottled, firm subsoil is about 10 inches thick. The upper part is brown and pale brown loam, and the lower part is dark yellowish brown clay loam. The substratum to a depth of about 60 inches is gray, mottled, firm, calcareous loam. In some places the solum is thicker than 25 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Poseyville and Wixom soils and the poorly drained Parkhill soils. The Poseyville and Wixom soils are on the higher knobs and small knolls in the broad flat areas. They have a sandy surface layer and upper subsoil. The Parkhill soil is in shallow depressions and drainageways. These included areas make up 5 to 20 percent of the unit.

Permeability is moderate to moderately slow, and surface runoff is slow. Available water capacity is high. The shrink-swell potential is moderate. The surface layer is friable and is easily tilled throughout a wide range of moisture content. A seasonal high water table fluctuates between depths of 1 and 2 feet. Potential frost action is high.

Most of the acreage is farmed. Potential is good for cultivated crops, pasture, woodland, and wildlife. It is poor for most engineering uses and fair to poor for recreational facilities.

This soil is suited to corn, soybeans (fig. 9), small grain, sugar beets, grass-legume hay, and pasture. The seasonal high water table can be lowered by tile or open ditch drainage.

This soil is suited to pastureland. Grazing when the soil is wet, however, results in surface compaction, excessive runoff, and poor tilth. Restricted use during wet periods helps to keep the pasture and soil in good condition.

This soil is suited to woodland. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Site preparation, prescribed burning, or spraying, cutting, or girdling is needed.

This soil is poorly suited to onsite sewage disposal, building site development, and local roads and streets. The seasonal high water table and the moderate to moderately slow permeability are severe limitations for onsite water disposal. The combination of these two properties may result in pollution of ground water supplies. Connecting sewage disposal facilities to a public sewerage system should be considered. The seasonal high water table and the moderate shrink-swell potential make building site development difficult. All buildings should have tile drainage or suitable fill at the base to prevent soil saturation. The natural soil should be removed and other soil with less shrink-swell potential filled in around the footings and foundations. When building local roads, a suitable base material should be laid over the natural soil to prevent shrink-swell or frost action damage.

Capability subclass IIw.

MeB—Menominee sand, 2 to 6 percent slopes. This gently sloping, moderately well drained soil occupies low knolls and broad convex areas. It is commonly associated with escarpments adjacent to alluvial areas. It is 20 to 40 inches of sandy material over loamy material. Individual areas are irregular in shape and range from 2 to 40 acres.

Typically, the surface layer is very dark grayish brown sand about 6 inches thick. The subsurface layer is pinkish gray, loose sand about 2 inches thick. The upper 22 inches of the subsoil is dominantly brown, loose sand. The lower part and the substratum to a depth of about 60 inches are reddish brown, firm silty clay loam. In some places no precipitated iron, aluminum, and organic matter have accumulated. In places the substratum is clayey.

Included with this soil in mapping are small areas of the somewhat poorly drained Wixom soils, the poorly drained Kingsville soils, and the poorly drained or very poorly drained Belleville soils. The Wixom soil is lower on the knolls and broad convex areas. The Kingsville and Belleville soils are in shallow depressions and drainageways. These included areas make up 3 to 15 percent of the unit.

Permeability is rapid in the sand and moderately slow in the loamy material. Available water capacity is moderate, and surface runoff is slow to medium. The surface layer is friable and is easily tilled throughout a fairly wide range of moisture content. A seasonal high water table fluctuates between depths of 2 1/2 and 6 feet or more. The soil is subject to blowing.

Most of the acreage is idle grassland or woodland. Potential is fair for cultivated crops and fair to poor for pasture. It is good for woodland, poor to fair for wildlife and recreation, and poor for most engineering uses.

This soil is suited to cropland. It can be droughty in summer, and it is subject to soil blowing and water erosion. Irrigation is needed. Minimum tillage, stripcropping, winter cover crops, and grassed waterways help to prevent excessive soil loss. Returning crop residue or regularly adding other organic material increases fertility and available water capacity.

This soil is suited to pasture. Proper pastureland management is effective in controlling erosion. Overgrazing depletes the vegetation and exposes the soil to erosion. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture and soil in good conditon.

This soil is suited to woodland. Seedling mortality can be high because of the droughtiness. Planting drought resistant species, mulching, and irrigating reduce this problem. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Site preparation, prescribed burning, or spraying, cutting, or girdling is needed.

This soil is poorly suited to onsite waste disposal. The seasonal high water table and moderately slow permeability are limitations. Connecting sewage disposal facilities to a public sewerage system should be considered. The seasonal high water table makes site development for buildings with basements more difficult. Tile or open ditch drainage is needed.

Capability subclass IIIs.

OaB—Oakville fine sand, 0 to 6 percent slopes. This nearly level to gently sloping, moderately well drained soil is on low knolls and convex ridges. Individual areas are narrow or irregular in shape and range from 2 to 150 acres.

Typically, the surface layer is very dark grayish brown fine sand about 7 inches thick. The subsurface layer is light brownish gray, loose fine sand about 7 inches thick. The subsoil is dark brown and brown, loose sand about 16 inches thick. The substratum to a depth of about 60 inches is pale brown, loose fine sand. In some places precipitated iron, aluminum, and organic matter have accumulated.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soils and poorly drained Kingsville soils. The Pipestone soil is on side slopes and the slightly lower areas of the knolls and ridgetops. The Kingsville soil is in shallow depressions and drainageways of the knolls and ridges. These included areas make up 3 to 15 percent of the unit.

Permeability is very rapid, and available water capacity is low. Surface runoff is very slow. A seasonal high water table fluctuates between depths of 3 and 6 feet or more.

Most of the acreage is woodland or idle grassland. Potential is poor for crops, pasture, wildlife, and most engineering uses. It is poor to fair for recreation and fair for woodland.

This soil is suited to crops or pasture. It can be droughty most of the growing season because of the low available water capacity. It is subject to soil blowing. Irrigation is needed. It should be almost continuous because of the fast intake and very rapid permeability. Minimum tillage, stripcropping, and winter cover crops reduce the risk of erosion.

Using the soil as pasture is also effective in controlling erosion. During the drier, warmer part of the growing season the pasture is easily damaged by overgrazing and droughtiness. Proper stocking rates, pasture rotation, and restricted or deferred grazing during the droughty periods keep the pasture in good condition.

This soil is suited to woodland. Droughtiness causes extensive seedling mortality. Planting drought resistant species and mulching reduce the effects of droughtiness. Competing vegetation must be controlled or removed so that tree seeds, cuttings, and seedlings survive and grow well. Site preparation, prescribed burning, or spraying, cutting, or girdling is needed.

This soil is poorly suited to onsite waste disposal systems. The seasonal high water table is a severe limitation. The high water table and very rapid permeability can cause effluent seepage and result in pollution of ground water supplies. Connecting sewage disposal facilities to a public sewerage system should be considered. The seasonal high water table makes site development for buildings with basements more difficult. Tile drainage is needed. If excavation is needed, the walls can be shored to prevent caving.

Capability subclass IVs.

Pa—Parkhill loam. This nearly level, poorly drained and very poorly drained soil is in broad low areas, small depressions and drainageways, and along the base of ridges. It is subject to frequent flooding. Individual areas are irregular in shape and range from 3 to 3,500 acres.

Typically, the surface layer is very dark brown loam about 8 inches thick. The subsoil is grayish brown and gray, friable loam about 17 inches thick. The substratum to a depth of about 60 inches is gray and grayish brown, calcareous loam. In some areas solum thickness and depth to free carbonates are less than 20 inches. Some areas have sandy surface textures or thin sandy bands in the subsoil. In places there is more clay in the substratum than is typical.

Included with this soil in mapping are small areas of the somewhat poorly drained Londo and Poseyville soils. They occupy slightly higher areas or low knolls. Also included are small areas of the poorly drained and very poorly drained Belleville soils, which have 20 to 40 inches of sand over loamy material. They are in the same low areas and drainageways. These included areas make up 5 to 15 percent of the unit.

Permeability is moderately slow, and available water capacity is high. Surface runoff is very slow to ponded. A seasonal high water table is within a depth of 1 1/2 feet. Potential frost action is high.

Most of the acreage is cropland. Some small areas are in native hardwoods. Potential is good for cropland, hayland, pastureland, and woodland. It is poor for recreation and for most engineering uses.

This soil is suited to corn, soybeans, and small grain. The major problem is the wetness from ponding and the seasonal high water table. Ditching and tiling are needed. Field stripcropping, minimum tillage, winter cover crops, and regular additions of crop residue or other organic matter help to maintain soil fertility, improve tilth, and control erosion.

This soil is suited to hay or pasture. Excess water is the major problem. Ditching and tiling are needed. Selection of wetland plant species, proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the vegetation and the soil in good condition.

This soil is well suited to trees. It has the potential for moderately high wood yields. Ponding and wetness cause severe equipment limitations and severe plant competition. Removing obstructions from the natural drainageways is needed. Harvesting when the soil is dry or frozen also is needed. Cutting or girdling undesirable species reduces plant competition. Wetness results in moderate seedling mortality and windthrow. Improving runoff is needed. Onsite forestry assistance is desirable if the stands are hardwoods.

This soil is poorly suited to building site development, sanitary facilities, and local roads and streets. Flooding, wetness, and slow percolation are the major problems. Generally, using these areas for sanitary facilities is not economically feasible. Using fill material and footing drains for local roads and streets helps to control excess water.

Capability subclass IIw.

Pe—Pella silt loam. This nearly level, poorly drained soil is in low flat areas and drainageways. It is subject to occasional flooding. Individual areas are irregular in shape and range from 3 to 1,600 acres.

Typically, the surface layer is black silt loam about 12 inches thick. The subsoil is olive gray silt loam and silty clay loam about 8 inches thick. The upper part of the substratum is olive, friable silty clay loam, and the lower part to a depth of 60 inches is grayish brown, friable silt loam and very fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Ingersoll, Pipestone, and Wixom soils. Ingersoll soils are in a higher position on the landscape. Pipestone soils are sandy throughout and occupy broad flat areas, low ridges, and side slopes. Wixom soils have 20 to 40 inches of sand over loamy material. They are in flat areas and on low knolls and ridges. These included areas make up 5 to 20 percent of the unit.

Permeability is moderate, and surface runoff is slow to ponded. A seasonal high water table is within a depth of 2 feet. The available water capacity is high. Potential frost action is high.

Most of the acreage is idle grassland or woodland. Potential is good for cultivated crops, hay, and pasture. It is poor for woodland, recreation, and most engineering uses.

This soil is suited to corn, soybeans, and small grain. Wetness and soil blowing are the major problems. Ditch and tile drainage are needed. Field stripcropping, minimum tillage, and winter cover crops help to prevent excessive soil loss. Returning crop residue or regularly adding other organic matter improves fertility and increases available water capacity.

Using this soil for pasture and hayland is effective in controlling erosion. Wetness is the major problem. Ditch or tile drainage is needed. Livestock should be fenced away from the ditches to help control bank erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition.

This soil is suited to trees. Much of the acreage remains in native species. Because wetness is a major problem, ratings are severe for equipment limitations, seedling mortality, windthrow hazard, and plant competition. Removing obstructions from drainageways and increasing the depth improve drainage. Spraying, cutting, or girdling of undesirable species and proper site preparation reduce plant competition. Erosion is little or no hazard in fully stocked woodland.

This soil is poorly suited to building site development and sanitary facilities. The major problems are wetness, occasional flooding, and low strength. Artificial drainage is needed. Connecting sewage disposal facilities to a public sewerage system should be considered. Wetness, flooding, and frost action are severe limitations for roads.

Capability subclass IIw.

PsB—Pipestone sand, 0 to 3 percent slopes. This nearly level to gently sloping, somewhat poorly drained soil is in broad flat areas and on narrow convex ridgetops and side slopes. Individual areas are narrow or irregular in shape and range from 2 to 1,600 acres.

Typically, the surface layer is black and grayish brown sand about 6 inches thick. The subsoil is about 18 inches thick. The upper part is yellowish brown, very friable sand. The lower part and the substratum to a depth of about 60 inches are multicolored, loose sand. In some places no precipitated iron, aluminum, and organic matter have accumulated.

Included with this soil in mapping are small areas of the Pipestone loamy substratum soils, the moderately well drained Covert soils, and the poorly drained Kingsville and Kinross soils. Pipestone loamy substratum soils have a loamy substratum at a depth of 40 to 60 inches. They occupy the same kind of position on the landscape as the Pipestone soils. Covert soils are on the steeper slopes and in higher positions on the ridges and low knolls of the broad flat areas. Kingsville and Kinross soils are in the shallow depressions and drainageways. These included areas make up 2 to 20 percent of the unit.

This soil has rapid permeability and low available water capacity. Surface runoff is slow or very slow. A seasonal high water table fluctuates between depths of 1/2 foot and 1 1/2 feet.

Most of the acreage is woodland or idle grassland. Potential is fair for woodland. It is poor for cultivated crops, pasture, wildlife, recreation, and most engineering uses.

If adequately drained, this soil is suited to crops or pasture. It has a seasonal high water table, can be droughty in summer, and is subject to soil blowing. Tile or open ditch drainage lowers the high water table. Extensive irrigation is needed. Minimum tillage and winter cover crops reduce the risk of soil blowing.

This soil is suited to woodland. Wetness causes high seedling mortality and limits equipment use. Plowing in fall and planting in spring on the furrow tops reduce the effects of wetness.

This soil is poorly suited to onsite waste disposal, building site development, and local roads and streets. The seasonal high water table and rapid permeability can cause effluent seepage and result in pollution of ground water supplies. Connecting sewage disposal facilities to a public sewerage system should be considered. The seasonal high water table and unstable soil conditions make building site development difficult. When saturated, the soil liquifies and flows. Tile drainage lowers the water table and helps to prevent saturation. Filling with a more stable material also helps to lower the water table and reduces instability. If excavation is needed, the walls can be shored to prevent caving. In building local roads, a suitable base material should be laid to prevent damage from frost action.

Capability subclass IVw.

PtB—Pipestone sand, loamy substratum, 0 to 3 percent slopes. This nearly level to gently sloping, somewhat poorly drained soil is in broad, flat areas and on narrow convex ridgetops and side slopes. Individual areas are narrow or irregular in shape and range from 3 to 500 acres.

Typically, the surface layer is very dark gray sand about 8 inches thick. The subsurface layer is grayish brown, loose sand about 2 inches thick. The subsoil is about 19 inches of multicolored, very friable sand. The upper 23 inches of the substratum is multicolored, loose sand, and the lower part to a depth of about 60 inches is reddish gray, firm clay loam. In some places no precipitated iron, aluminum, and organic matter have accumulated.

Included with this soil in mapping are small areas of the moderately well drained Covert soils, the somewhat poorly drained Wixom soils, and the poorly drained or very poorly drained Belleville soils. Covert soils are steeper and occupy the higher positions on the narrow convex ridgetops. Wixom soils have a loamy substratum at 20 to 40 inches. Some are lower on the side slopes. Some are in the broad, flat areas. Belleville soils are in shallow depressions and drainageways. These included areas make up 5 to 20 percent of the unit.

Permeability is rapid in the sandy material and slow or moderately slow in the loamy material. Available water capacity is low. Surface runoff is slow or very slow. The surface layer is friable and is easily tilled throughout a fairly wide range of moisture content. A seasonal high water table fluctuates between depths of 1/2 foot and 1 1/2 feet.

Most of the acreage is woodland or idle grassland. Some areas are farmed or pastured. Potential is fair for cultivated crops, pasture, and woodland. It is poor for wildlife, recreation, and most engineering uses.

This soil is suited to cropland or pasture. It has a seasonal high water table, can be droughty in summer, and is subject to soil blowing. Tile or open ditch drainage lowers the apparent high water table. Extensive irrigation is needed. Minimum tillage and a winter cover crop reduce the risk of soil blowing.

This soil is suited to woodland. Wetness causes seedling mortality and limits equipment use. Plowing in fall and planting in spring on the furrow tops reduce the effects of the wetness.

This soil is poorly suited to onsite waste disposal. The seasonal high water table is a severe limitation. The seasonal high water table and rapid permeability can cause effluent seepage and result in pollution of ground water supplies. Connecting sewage disposal facilities to a public sewerage system should be considered. The seasonal high water table makes building site development difficult. When saturated, the soil liquifies and flows. Tile drainage lowers the water table and prevents saturation. Filling with a more stable material also helps to lower the water table and overcome the instability. If excavation is needed, walls can be shored to prevent caving. In constructing local roads, a suitable base material should be laid over the natural soil to prevent drainage from frost action.

Capability subclass IIIw.

PuB—Pipestone-Oakville-Urban land complex, 0 to 6 percent slopes. This map unit consists of nearly level to gently sloping soils on outwash and lake plains and narrow ridges. It is 40 to 50 percent somewhat poorly drained Pipestone soil, 20 to 30 percent moderately well drained Oakville soil, and 15 to 25 percent Urban land. Individual areas of this unit range from 80 to 1,000 acres. The areas of each soil and Urban land were so intricately mixed or so small in size that it was not practical to map them separately.

Typically, the Pipestone soil has a surface layer of black and grayish brown sand about 6 inches thick. The subsoil is about 18 inches thick. The upper part is yellowish brown, mottled, very friable sand. The lower part and the substratum to a depth of about 60 inches are multicolored, loose sand.

Typically, the Oakville soil has a surface layer of very dark grayish brown fine sand about 7 inches thick and a subsurface layer of light brownish gray fine sand about 7 inches thick. The subsoil is dark brown and brown fine sand about 16 inches thick. The substratum to a depth of about 60 inches is pale brown, loose fine sand.

In places the Pipestone and Oakville soils have been radically altered. Some of the low areas have been filled or leveled during construction, and other small areas have been cut, built up, or smoothed. Approximately 75 percent of the natural surface layer has been disturbed during the construction of buildings and streets. Most of the disturbance has resulted from the spreading of soil material excavated for basements and streets. Most of the fill is less than 18 inches thick over the original soil. In some small depressional areas the fill is thicker. Some of the high spots have been smoothed.

Typically, the Urban land part of this unit is covered by streets, parking lots, buildings and other structures, and no soil identification is possible.

Included in mapping and making up 2 to 10 percent of the unit are small areas of Plainfield and Kingsville soils. The excessively drained Plainfield soil is in the higher convex areas. The poorly drained Kingsville soil is in depressional areas and drainageways.

Permeability is rapid in the Pipestone soil and very rapid in the Oakville soil. Available water capacity is low in both. The Oakville soil has low shrink-swell and frost action potential. The Pipestone soil has moderate potential frost action. The seasonal high water table fluctuates between depths of 1/2 foot and 1 1/2 feet in the Pipestone soil and between 3 and 6 feet or more in the Oakville soil.

Pipestone and Oakville soils, the open parts of the unit, are mainly lawns and parks. They have poor potential for lawns and gardens, fair potential for trees, and poor to fair potential for recreation. The Pipestone soil has poor potential for most engineering uses, and the Oakville soil poor to fair potential.

Pipestone and Oakville soils are poorly suited to grasses, flowers, vegetables, and shrubs because of droughtiness. A proper watering schedule and selection of drought tolerant species are needed to overcome this problem. Bare areas should be planted or covered to prevent soil blowing.

These soils are suited to trees. The high seedling mortality can be overcome by watering, planting, or covering to prevent soil blowing and by eliminating competing plants.

The Pipestone soil is poorly suited to onsite sewage disposal, building site development, and local roads and streets because of wetness. The Oakville soil is suited to dwellings and small commercial buildings without basements and to local roads and streets. All buildings should be constructed with footing drains. When excavations are made, both soils tend to cave. Shoring cutbanks and installing tile drains are needed to overcome the problems of the caving cutbanks and the wetness.

Limitations are severe for picnic areas and playgrounds. Artificial drainage, seeding of bare areas, and irrigation during the dry season are needed to overcome the problems of wetness, excess sand, and droughtiness. Onsite investigation is essential to properly evaluate and plan the development of specific sites.

Not assigned to a capability subclass.

PwB—Plainfield sand, 0 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on high ridges, knolls, and flat areas. Individual areas are irregular in shape and range from 2 to 120 acres.

Typically, the surface layer is very dark brown and grayish brown sand about 6 inches thick. The subsoil, about 19 inches thick, and the substratum to a depth of 60 inches are multicolored, dominantly loose sand. In some places, weak accumulations of precipitated iron, aluminum, and organic matter are in the lower subsoil.

Included with this soil in mapping are small areas of the moderately well drained Covert soils on knolls and ridges and areas of the somewhat poorly drained Pipestone soils on low knolls, ridges, and side slopes. Also included are the poorly drained Kingsville soils on broad flats and in shallow depressions and drainageways. These included areas make up 5 to 20 percent of the unit.

Permeability is rapid, and surface runoff is slow. Available water capacity is low.

Most of the acreage is woodland. Potential is poor for cropland, hayland, and pastureland and fair for woodland and recreation. It is good to poor for most engineering uses.

This soil is suited to cultivated crops. Irrigation is needed to overcome the drought hazard. In cultivated areas, soil blowing is a hazard. Field stripcropping, minimum tillage, and winter cover crops help to prevent excessive soil loss. Returning crop residue or regularly adding other organic matter improves fertility and increases available water capacity.

This soil is suited to pasture or hayland. Low available water capacity is the major problem. Increasing the organic matter content and irrigating greatly improve the suitability. Proper stocking rates, pasture rotation, and timely deferment of grazing during critical periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Much of the acreage remains in native species or has been planted to evergreens. The major problem is high seedling mortality because of low available water capacity. Plant competition is slight for hardwoods and moderate for conifers. Competition can be partially overcome by fern control, species selection, and ideal planting procedures. There is little or no problem with erosion, equipment limitation, or windthrow.

This soil is suited to recreation uses. The major problem is sandy texture. If exposed, the sand blows, which makes the soil poorly suited to playgrounds. Covering intensively used areas with such material as wood chips and planting drought-tolerant grass species help overcome these problems.

This soil is suited to septic tank absorption fields, but pollution of ground water is a hazard because of the rapid permeability. Limitations for sewage lagoons and sanitary landfill are severe because of seepage into the ground water supply. The soil is too sandy for use as landfill cover. The areas are difficult to reclaim.

This soil is suited to building site development and local roads and streets. Limitations are slight for most uses. Excavations have severe limitations because of caving. Shoring helps to control this problem. Topsoil and irrigation are needed for lawns.

Capability subclass VIs.

PxB—Poseyville-Londo complex, 0 to 4 percent slopes. This map unit consists of nearly level to gently sloping, somewhat poorly drained soils on low knolls, at the base of slopes, and in drainageways.

Individual areas of this unit range from 10 to 225 acres. They are 50 to 60 percent Poseyville soil and 30 to 40 percent Londo soil. The Poseyville soil is in the slightly convex, higher areas, and the Londo soil is in the slightly concave areas and the drainageways. Areas of each soil were so intricately mixed or so small in size that it was not practical to map them separately.

Typically, the Poseyville soil has a surface layer of very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is about 5 inches of brown sand. The subsoil, about 7 inches thick, is dominantly yellowish brown, mottled sandy loam. The substratum to a depth of about 60 inches is gray, mottled loam.

Typically, the Londo soil has a surface layer of very dark brown loam about 9 inches thick. The mottled, firm subsoil is about 10 inches thick. The upper part is brown loam, and the lower part is yellowish brown clay loam. In places the subsoil contains weak accumulations of precipitated iron, aluminum, and organic matter. The substratum to a depth of about 60 inches is gray, mottled loam.

Included with these soils in mapping and making up 10 to 20 percent of the unit are small areas of the poorly drained and very poorly drained Belleville and Parkhill soils. They are in drainageways and slightly concave areas.

In the Poseyville soil permeability is rapid above the substratum and moderate or moderately slow in the substratum. The Londo soil has moderate or moderately slow permeability. The available water capacity is moderate in the Poseyville soil and high in the Londo soil. Surface runoff is slow. The seasonal high water table fluctuates between depths of 1 and 2 feet. Potential frost action is high, and the shrink-swell potential is moderate.

Most of the acreage is cropland. Some areas are woodland. Potential is good for farming and forestry. It is poor for engineering and recreational uses.

This unit is suited to cropland. The major problem in cropland management is the seasonal high water table. Artificial drainage is needed. The main crops are corn, wheat, beans, and sugar beets with some mixed hay and pasture.

This unit is suited to trees. Some areas remain wooded. Tree seeds, cuttings, and seedlings survive and grow well if competing vegetation is controlled or removed. Site preparation, prescribed burning, or spraying, cutting or girdling is needed.

These soils are poorly suited to onsite sanitary facilities, building site development, and local roads and streets. The seasonal high water table is a severe limitation for sanitary facilities and building site development. Connecting sewage disposal facilities to a public sewerage system should be considered. Artificial drainage should be provided around buildings to keep the soil from becoming saturated. In places, a suitable base material for local roads and streets must be hauled in from outside the area.

Capability subclass IIw.

Sz—Sloan loam. This nearly level, very poorly drained soil is on bottom land. It is subject to frequent flooding. Individual areas are generally long and narrow and bordered on the upland side by escarpments. Areas range from 2 to 270 acres.

Typically, the surface layer is very dark brown loam about 12 inches thick. The dominantly grayish subsoil is about 28 inches thick. The upper part is friable loam, and the lower part is firm clay loam. The calcareous substratum to a depth of about 60 inches dominantly is grayish sandy loam and silty clay loam. In some small areas, slightly higher on the landscape, the surface layer is thinner and lighter colored than is typical.

Included with this soil in mapping are small areas of moderately well drained Abscota soils; somewhat poorly drained, coarser textured soils; and poorly drained to very poorly drained Cohoctah soils. Abscota soils occupy the highest positions on the bottom land. The coarser textured soils are slightly lower in level to nearly level areas. Cohoctah soils occupy the lowest nearly level areas and the drainageways. These included areas make up 2 to 10 percent of the unit.

Permeability is moderate or moderately slow, and available water capacity is high. Surface runoff is slow to ponded. A seasonal high water table is within a depth of 1/2 foot. Potential frost action is high.

Most of the acreage is native woodland. Potential is poor for cropland, hayland, and pastureland and fair for woodland. It is poor for recreation and most engineering uses.

Where flood control and drainage are not practical, this soil is not suited to cultivated crops, hay, or pasture. Where practical, diking, ditching, and tile drainage are needed.

This soil is suited to trees. It has the potential for high wood yields. Flooding and wetness are the major problems. These problems can be partially overcome by removing obstructions from the natural drainageways. The wetness causes severe equipment limitations, high seedling mortality, and a severe windthrow hazard. Use of equipment is limited to seasons when the soil is dry or frozen. Drainage reduces seedling mortality and lowers the rate of windthrow damage.

Generally, this soil is not suited to sanitary facilities, building site development, and local roads and streets because of wetness and flooding.

Capability subclass Vw.

Ur—Urban land. This map unit is a continuous, irregularly shaped, nearly level area covered by streets, parking lots, and buildings. It occurs within industrial complexes. Included are bodies of water ranging from 5 to 40 acres. Typically, Urban land is underlain by sandy or loamy substratum material.

Included in mapping and making up 1 to 15 percent of the unit are small areas of Aquents and undisturbed soils that vary greatly in soil properties. These randomly scattered areas of soils occur throughout the unit.

The use of Urban land as a site for built-up areas precludes its use for most other purposes.

Most areas are drained through storm sewers, gutters, drainage tile, and, to a lesser extent, surface ditches. In undrained areas the seasonal high water table is within 3 feet of the surface.

The potential for most engineering uses varies greatly. Onsite investigation is needed to determine the hazards and degree of limitation for specific uses.

Not assigned to a capability subclass.

Wa—Wauseon sandy loam. This nearly level, poorly drained and very poorly drained soil is in low flat areas and drainageways. It is subject to frequent flooding. Individual areas are irregular in shape and range from 4 to 180 acres.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsoil, about 27 inches thick, is dark gray and gray sandy loam. The substratum to a depth of about 60 inches is gray and olive, very firm silty clay. In places, the surface layer is thinner or lighter colored than is typical.

Included with this soil in mapping are small areas of the somewhat poorly drained Wixom and Pipestone loamy substratum soils. They are on low knolls and ridges. Also included are small areas of the poorly drained and very poorly drained Belleville soils, which have 20 to 40 inches of sandy material over loamy material. They are in low flat areas and drainageways. These included areas make up 5 to 15 percent of the unit.

Permeability is rapid in the loamy material and very slow in the clayey material. Surface runoff is very slow, and available water capacity is medium. A seasonal high water table is within a depth of 1/2 foot. The clayey material has high shrink-swell potential. Potential frost action is moderate.

Most of the acreage is idle grassland or woodland. Potential is good to fair for crops, fair for hay and pasture, and poor to fair for woodland. It is poor for recreation and for engineering uses.

This soil is suited to corn, soybeans, and small grain. Wetness and soil blowing are the major problems. Ditch and tile drainage help to control wetness. Field stripcropping, minimum tillage, and winter cover crops help to prevent excessive soil loss. Returning crop residue or regularly adding other organic matter improves fertility and increases the available water capacity.

Using this soil as pastureland or hayland also is effective in controlling erosion. Wetness is the major problem. Ditch or tile drainage helps to control the wetness. Livestock should be fenced away from the ditches to reduce the risk of bank erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Much of the acreage remains in native species. Wetness, the major problem, results in severe limitations for equipment use and severe plant competition. Seedling mortality and windthrow are moderate to severe. Removing obstructions from drainageways improves drainage. Cutting or girdling of undesirable species reduces the plant competition. There is little or no erosion hazard.

This soil is poorly suited to building site development and onsite waste disposal. The major problems are wetness, slow permeability, and high shrink swell in the clayey material. The soil should be artificially drained. Connecting sewage disposal facilities to a public sewerage system should be considered. Wetness, shrink swell, and frost action are severe limitations in constructing local roads and streets. They can be partially overcome by replacing the base material with suitable material.

Capability subclass IIIw.

WxB—Wixom loamy sand, 0 to 3 percent slopes. This nearly level to gently sloping, somewhat poorly drained soil is in flat areas and on low knolls and ridges. Individual areas are irregular in shape and range from 3 to 500 acres.

Typically, the surface layer is very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is about 5 inches of grayish brown fine sand. The mottled subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable fine sand; the next part is pale brown, very friable fine sand; and the lower part is brown, firm sandy clay loam. The substratum to a depth of about 60 inches is reddish brown, firm silty clay loam. In some places, no precipitated iron, aluminum, and organic matter have accumulated. In some soils less than 20 inches of sand overlies the loamy material. In some the substratum is more than 35 percent clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone loamy substratum soils, which have 40 to 60 inches of sand over loamy material. They are on low knolls and ridges. Also included are the poorly drained and very poorly drained Belleville and Parkhill soils. They are in narrow drainageways and depressions. These included areas make up 10 to 20 percent of the unit.

Permeability is rapid in the sandy material and moderately slow in the loamy material. Surface runoff is slow. Available water capacity is moderate. A perched high water table fluctuates between depths of 1 and 2 feet. The shrink-swell potential is low.

Most of the acreage is farmed. Potential is fair for crops, fair to good for hay and pasture, and good to fair for woodland and wildlife. It is fair to poor for recreation and poor for most engineering uses.

This soil is suited to corn, soybeans, and small grain. Wetness and soil blowing are the major problems. Ditch and tile drainage help to control wetness (fig. 10). Field stripcropping, minimum tillage, and winter cover crops help to prevent excessive soil loss. Returning crop residue or regularly adding other organic matter improves fertility and increases available water capacity.

This soil is suited to hay and pasture. Wetness is the major problem. Ditch or tile drainage is needed. Livestock should be fenced away from ditches to reduce the risk of bank erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Much of the wooded acreage remains in native species. Wetness, the major problem, results in high seedling mortality and a moderate equipment limitation. Removing obstructions from natural drainageways improves drainage. Plant competition, erosion, and windthrow are not concerns.

This soil is poorly suited to building site development and sanitary facilities. Wetness is the major limitation. Artificial drainage is needed. Connecting sewage disposal facilities to a public sewerage system should be considered. Footing drains are needed around foundations for buildings. Construction of roads and streets is limited by wetness, low strength, and shrink swell and by frost action in the finer textured soil material. These problems can be controlled by drainage and by strengthening or replacing the base material. Suitable topsoil is needed for lawns.

Capability subclass IIIw.

WzB—Wixom-Belleville-Urban land complex, 0 to 3 percent slopes. This map unit is 35 to 45 percent nearly level to gently sloping, somewhat poorly drained Wixom soils; 20 to 30 percent nearly level, poorly drained and very poorly drained Belleville soils; and 15 to 25 percent Urban land. It is in broad flat areas and on low knolls and ridges. The Belleville soil is subject to frequent flooding. Individual areas of this unit range from 80 to 1,000 acres. The areas of each soil and Urban land were so intricately mixed or so small in size that it was not practical to map them separately.

Typically, the Wixom soil has a surface layer of very dark grayish brown loamy sand about 9 inches thick. The subsurface layer is about 5 inches of grayish brown fine sand. The mottled subsoil is about 20 inches thick. The upper part is dark yellowish brown, friable fine sand; the next part is pale brown, very friable fine sand; and the lower part is brown, firm sandy clay loam. The substratum to a depth of about 60 inches is reddish brown, firm silty clay loam.

Typically, the Belleville soil has a surface layer of black loamy sand about 8 inches thick. The subsurface layer is very dark grayish brown sand about 5 inches thick. The substratum to a depth of 60 inches is pale brown and grayish brown sand in the upper part and grayish brown silty clay loam in the lower part.

The Urban land part of the unit is covered by streets, parking lots, buildings, and other structures, and no soil identification is possible.

Approximately 75 percent of the natural surface layer of the Wixom and Belleville soils has been disturbed during the construction of buildings and streets. Most of the disturbance has resulted from the spreading of soil material excavated for basements and streets. Most of the fill is less than 18 inches thick over the original soil. In some small depressional areas the fill is thicker. Some high spots have been smoothed.

Included in mapping and making up 15 to 25 percent of the unit are small areas of the somewhat poorly drained Bowers soils and the poorly drained and very poorly drained Lenawee and Parkhill soils. The Bowers soil is in flat or slightly convex areas. It has a loamy surface layer and subsoil. The Lenawee soil is in depressional areas or drainageways and is loamy or clayey throughout. The Parkhill soil is in depressional areas or drainageways and is loamy throughout. In some included soils the substratum is more than 35 percent clay.

Wixom and Belleville soils have rapid permeability in the sandy upper part and moderately slow permeability in the loamy substratum. Surface runoff is slow on the Wixom soil and very slow or ponded on the Belleville soil. Available water capacity in both is moderate. In the Wixom soil the seasonal high water table fluctuates between depths of 1 and 2 feet. In the Belleville soil it is within a depth of 1 foot. In both soils, the shrink-swell potential is high in the loamy substratum, and potential frost action is moderate.

Wixom and Belleville soils, the open parts of the unit, are lawns, gardens, parks, and playgrounds. They have poor potential for lawns, gardens, and most engineering uses. Potential for recreation is poor to fair on the Wixom soil and poor on the Belleville soil. Potential for trees and shrubs is fair on the Wixom soil and poor on the Belleville soil.

Wixom and Belleville soils are poorly suited to grasses, flowers, and vegetables because of the sandy topsoil and the wetness. Artificial drainage, selection of water-tolerant plant species, and watering during dry periods are needed to overcome these problems. Bare spots should be covered or planted to reduce the risk of soil blowing. These management techniques are also needed for trees and shrubs.

The Wixom and Belleville soils have severe limitations for sanitary facilities and building site development. The Belleville soil should be protected from flooding. Connecting sewage disposal facilities to a public sewerage system should be considered. Shallow excavations should be drained and shored to help in preventing cutbanks from caving. For dwellings, basements, local roads, and small commercial buildings, drainage and proper fill material are needed to overcome the problems of wetness and low strength. Construction in or on the loamy substratum should include suitable fill material or drainage to overcome the moderate shrink-swell potential. If these soils are to be used for recreation, artificial drainage and watering during dry periods are needed. Onsite investigation is essential to properly evaluate and plan the development of specific sites.

Not assigned to a capability subclass.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information about soil wetness and information that is useful in locating sources of sand and gravel, roadfill, and topsoil.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained (*6*); and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 68,000 acres in the survey area was used for crops and pasture in 1974, according to Michigan Department of Agriculture statistical data updated by USDA data. Of this total, 6,000 acres was permanent pasture; 47,000 acres row crops; and 8,000 acres rotation hay and pasture. An estimated 10,000 acres was idle cropland.

The soils in Midland County have good potential for increased production of food. About 30,000 acres of potentially good cropland and 80,000 acres of fair to good cropland is currently idle grassland, wild pasture, or low grade woodland. In addition to the reserve productivity represented by this land, food production can be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can help in applying such technology.

The acreage in cropland has been gradually decreasing. It was 98,000 acres in 1949 and 72,000 acres in 1972. This trend started in the early 1920's. Most of the decline in acreage is the result of abandonment of less efficient farms. Some cropland was taken for interstate highways, and some was converted to public utilities and industrial and community developments. Future change from cropland to other uses is expected to be very gradual. For suggestions on the use of this survey in making land use decisions that will influence the future role of farming in the county, see "General soil map for broad land use planning."

Soil drainage is the major management need on about four-fifths of the acreage used for crops and pasture. About half the acreage of the better cropland soils is poorly drained or very poorly drained. These are the poorly drained Pella soils and the poorly drained or very poorly drained Lenawee (fig. 11), Parkhill, and Wauseon soils. Without artificial drainage, production of the commonly grown crops is generally not possible.

Nearly half the acreage of the better cropland soils is somewhat poorly drained. These are the Bowers, Ingersoll, Londo, Poseyville, and Wixom soils. In most years, artificial drainage is needed.

Of the estimated 80,000 acres of potential cropland, three-fourths is somewhat poorly drained to poorly drained. These are the very poorly drained Adrian soils, the poorly drained Kingsville and Kinross soils, and the somewhat poorly drained Pipestone soils. Artificial drainage is needed for the commonly grown crops.

Tile drainage, ditching, and diking are mechanical measures that can help in improving drainage. In undrained areas, planting short season crops or winter grain is suggested. Planting crop species and varieties that are less subject to damage from wetness or growing wetland perennial hay or pasture species also helps to avoid the problems caused by wetness.

On most of the soils, finding drainage outlets is difficult because of the flat topography. Public drains are often used as drainage outlets. A more extensive public drainage system is needed to bring more cropland into production.

Information on the design, construction, and maintenance of the required drainage systems can be found in the Technical Guide, which is available in local offices of the Soil Conservation Service.

Soil blowing is the major problem on about one-fifth of the actively farmed acreage and on about one-third of the potential cropland. Blowing is a hazard in cropped areas of the Menominee, Poseyville and Wixom soils. It is also a problem on those Adrian, Covert, Oakville, Pipestone, and Plainfield soils that are potential cropland. Soil blowing can damage these soils in a few hours if the winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover or a surface mulch or leaving the surface rough through proper tillage minimizes the hazard of soil blowing.

Minimum tillage and field stripcropping at right angles to the path of the prevailing winds help in controlling soil blowing. Row crops alternated with hay or close grown crops complement the field stripcropping system. For intensive management on these soils, windbreaks of trees, shrubs, or tall growing grasses are needed to limit damage from soil blowing.

Information on designing a system of wind erosion control for each kind of soil is in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil tilth is an important consideration. Maintaining good soil tilth or structure is necessary on much of the cropland in this survey area. Poor tilth generally results in poor stands and lower yields. It decreases infiltration and the amount of available water in the loamy and clayey soils, for example the Bowers, Lenawee, Londo, Parkhill, and Pella soils. Adding organic matter improves tilth and the amount of available water in the sandy over loamy soils, for example, the Menominee, Poseyville, and Wixom soils.

Soil can be improved by increasing the supply of organic matter in the soil and limiting the time that the soil is without plant cover. Green organic matter should be applied regularly. Grass crops that have high root content should be included in the cropping system. Tillage should be kept to a minimum.

Soil fertility is naturally good in Ingersoll, Lenawee, Londo, Pella, and Wauseon soils. Natural fertility is good to moderately good in Bowers, Parkhill, Poseyville, and Sloan soils, fair in Belleville and Wixom soils, and fair to low in Adrian, Cohoctah, Kingsville, and Menominee soils. Natural fertility is low in Abscota and Oakville soils and low to very low in Covert, Kinross, Pipestone, and Plainfield soils.

Reaction ranges from very strongly acid to moderately alkaline in the surface layer of unlimed soils. Generally the unlimed sandy surface layer is acid and loamy surface layer is slightly acid to mildly alkaline. Lime and fertilizer should be applied according to soil tests and the needs of the crops (*4*).

Irrigation can have high potential on the sandy soils of the survey area. The water table fluctuates below depths of 5 feet but is still within pond or shallow well depth and is thus available for irrigation. If deep wells are used for irrigation, salt pollution can be a problem. Wells should be tested before use. Because the topography is flat in most cropland areas of the county, sprinkler or ditch irrigation is practical.

Irrigating helps in protecting tree fruits, bush fruits, strawberries, and possibly soybeans from frost damage.

Technical assistance in irrigation management is available through the local field office of the Soil Conservation Service.

Field crops suited to the soils and climate of the county include a few that are not now commonly grown. The commonly grown row crops are corn, field beans, soybeans and sugar beets. Grain sorghum, sunflowers, potatoes, and similar crops can be grown if economic conditions are favorable.

Wheat and oats are the common close grown crops. Rye, barley, buckwheat, and flax also are suitable. Grass seed can be produced from bromegrass, fescue, red clover, redtop, and bluegrass.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 6. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Woodland management and productivity

Table 7 contains information useful to woodland owners or forest managers planning use of soils for wood crops.

In table 7 the soils are rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth (fig. 12). A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 8 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 8, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 9 shows, for each kind of soil, the degree and kind of limitations for building site development; table 10, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, and open ditches. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Slope and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, and susceptibility to flooding. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 10 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 15 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel (fig. 13). A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel or stones.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel or stones; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 12 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 12 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs (fig. 14). Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 13 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 10, and interpretations for dwellings without basements and for local roads and streets, given in table 9.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water (fig. 15). If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 14, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are beggarweed, wild strawberry, lambsquarters, milkweed, and dandelion.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, raspberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are honeysuckle, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, burreed, and cattail and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 15 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 15 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 15 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. The estimated classification is given in table 15. Also in table 15 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 16 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 17 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years (fig. 16). The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Subsidence is the settlement of organic soils or of soils containing semifluid layers. Initial subsidence generally results from drainage. Total subsidence is initial subsidence plus the slow sinking that occurs over a period of several years as a result of the oxidation or compression of organic material.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*7*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 18, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquolls (*Aqu*, meaning water, plus *olls*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquolls (*Hapl*, meaning simple horizons, plus *aquolls*, the suborder of Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed, mesic, Typic Haplaquolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*5*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Abscota series

The Abscota series consists of moderately well drained, rapidly permeable soils on sandy flood plains. These soils formed in sandy alluvium. Slopes range from 0 to 6 percent.

Abscota soils are commonly adjacent to Cohoctah, Plainfield, and Sloan soils. Cohoctah soils are finer textured and wetter than Abscota soils. They are in shallow depressions or drainageways. Plainfield soils are excessively drained. They are on the ridges and knolls adjacent to the flood plains and are not subject to flooding. Sloan soils are finer textured than Abscota soils. They are in depressions or drainageways and are very poorly drained.

Typical pedon of Abscota loamy sand, 0 to 6 percent slopes, 2,800 feet west and 1,100 feet north of southeast corner sec. 17, T. 14 N., R. 2 E.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; few fine roots; neutral; clear wavy boundary.

B2—5 to 15 inches; yellowish brown (10YR 5/6) sand; weak fine subangular blocky structure; very friable; few fine roots; slightly acid; clear wavy boundary.

B3—15 to 22 inches; yellowish brown (10YR 5/8) sand; very weak fine subangular blocky structure; very friable; slightly acid; clear smooth boundary.

C1—22 to 40 inches; yellowish brown (10YR 5/6) sand; few fine faint brownish yellow (10YR 6/6) mottles; single grained; loose; slightly acid; clear smooth boundary.

C2—40 to 46 inches; light yellowish brown (10YR 6/4) sand; common fine distinct brownish yellow (10YR 6/6) mottles; single grained; loose; slightly acid; abrupt smooth boundary.

C3—46 to 50 inches; yellowish brown (10YR 5/6) sand; few fine distinct yellowish brown (10YR 5/8) mottles; single grained; many black (10YR 2/1) organic stains; loose; slightly acid; abrupt smooth boundary.

C4—50 to 60 inches; light yellowish brown (10YR 6/4) sand; few fine distinct light gray (10YR 7/2) and common medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; single grained; loose; slightly acid.

The thickness of the solum ranges from 20 to 30 inches. The content of organic carbon decreases irregularly with increasing depth.

The A horizon has value of 3 or 4 and chroma of 2 or 1. It is dominantly loamy sand but in places is sand or sandy loam.

The B2 and B3 horizons have value of 4 to 6 and chroma of 2 to 6. The texture is sand or loamy sand. Reaction ranges from slightly acid to mildly alkaline. Some pedons have a B1 horizon.

The C horizon has value of 4 to 6 and chroma of 3 to 6. The texture is sand or coarse sand. Gravelly sand is common below a depth of 50 inches. Reaction dominantly is slightly acid to mildly alkaline, but in some pedons it is moderately alkaline below 40 inches.

Adrian series

The Adrian series consists of very poorly drained soils that are moderately slowly to moderately rapidly permeable over rapidly permeable. These soils formed on lake and outwash plains in organic deposits 16 to 50 inches thick over sandy material. Slopes are 0 to 2 percent.

Adrian soils are commonly adjacent to Covert, Kingsville, and Pipestone soils. Covert soils are on the tops of low ridges and knolls and are moderately well drained. Kingsville soils lack organic layers. Pipestone soils are on the sides of low ridges and knolls and are somewhat poorly drained.

Typical pedon of Adrian muck, 40 feet south and 1,000 feet west of northeast corner sec. 3, T. 15 N., R. 1 E.

Oa1—0 to 12 inches; black (N 2/2) broken face, (N 2/0) rubbed sapric material; about 8 percent fibers, 3 percent rubbed; moderate fine crumb structure; primarily herbaceous fibers; neutral; abrupt wavy boundary.

Oa2—12 to 24 inches; very dark gray (N 3/0) broken face, dark brown (7.5YR 3/2) rubbed sapric material; about 12 percent fibers, 6 percent rubbed; weak thin platy structure; primarily herbaceous fibers; neutral; abrupt smooth boundary.

IIC1—24 to 30 inches; very dark brown (10YR 2/2) fine sand; single grained; loose; mildly alkaline; clear wavy boundary.

IIC2—30 to 60 inches; dark grayish brown (10YR 4/2) fine sand; single grained; loose; mildly alkaline.

Depth to the sandy IIC horizon ranges from 16 to 50 inches. The organic material is derived mainly from herbaceous plants. It ranges from strongly acid to mildly alkaline.

Typically, the surface tier is black (10YR 2/1, N 2/0, N 2/2). The organic part of the next tier has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 0 to 3. It is mainly sapric material. Some pedons, however, have thin layers of hemic material. These layers combined are less than 10 inches thick.

The IIC horizon dominantly has value of 2 through 5 and chroma of 1 or 2. It is dominantly fine sand, but in places is sand, loamy sand, gravelly sand, or gravelly loamy sand. In some pedons the upper 6 inches of the mineral horizon has value of 2 and chroma of 1 or 2. The C horizon ranges from slightly acid to moderately alkaline and in some pedons contains free carbonates.

Belleville series

The Belleville series consists of poorly drained and very poorly drained soils that are rapidly permeable over moderately slowly permeable. These soils are on lake and till plains. They formed in 20 to 40 inches of sandy glaciofluvium over loamy lacustrine or till material. Slopes are 0 to 2 percent.

Belleville soils are commonly adjacent to Kingsville, Pipestone loamy substratum, and Wixom soils. Kingsville soils are poorly drained and sandy throughout the solum and substratum. Pipestone loamy substratum soils are somewhat poorly drained. They have more than 40 inches of sand over the loamy substratum and have spodic horizons. They are on ridges and in slightly convex areas. Wixom soils are somewhat poorly drained and have spodic horizons. They occupy slightly higher positions on the landscape than Belleville soils.

Typical pedon of Belleville loamy sand, 150 feet east and 100 feet north of southwest corner sec. 24, T. 15 N., R. 1 E.

A11—0 to 8 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; granular structure; friable; slightly acid; clear smooth boundary.

A12—8 to 13 inches; very dark grayish brown (10YR 3/2) sand, grayish brown (10YR 5/2) dry; single grained; loose; slightly acid; gradual wavy boundary.

C1—13 to 24 inches; pale brown (10YR 6/3) sand; single grained; loose; neutral; clear wavy boundary.

C2g—24 to 30 inches; grayish brown (10YR 5/2) sand; single grained; loose; neutral; abrupt smooth boundary.

IICg—30 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common medium prominent yellowish red (5YR 5/6, 5/8) mottles; massive; firm; moderately alkaline.

Depth to the IIC horizon ranges from 20 to 40 inches.

The A11 horizon has value of 2 or 3 and chroma of 1 or 2. The A12 horizon has value of 2 or 3.

The Cg horizon has value of 4 to 6 and chroma of 1 or 2. It is sand or fine sand. In some pedons it is mottled.

The IICg horizon has chroma of 1 or 2. It is dominantly silty clay loam but in places is clay loam and loam.

Bowers series

The Bowers series consists of somewhat poorly drained, moderately slowly permeable soils on lake plains. These soils formed in silty and clayey, calcareous glaciolacustrine deposits. Slopes are 0 to 3 percent. The Bowers soils in this county are taxadjuncts to the Bowers series. They have a slightly warmer temperature than is defined as the range for the established series. This difference, however, does not alter the use or behavior characteristics of the soils.

Bowers soils are commonly adjacent to Wixom and Lenawee soils. Wixom soils are sandy in the upper part of the profile. They are on low knolls or ridges. Lenawee soils have a darker surface layer than Bowers soils. They are poorly drained or very poorly drained.

Typical pedon of Bowers silt loam, 0 to 3 percent slopes, 330 feet south and 1,400 feet east of northwest corner sec. 16, T. 15 N., R. 2 W.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to weak medium granular; friable; few fine roots; neutral; abrupt smooth boundary.

B&A—9 to 13 inches; dark brown (7.5YR 4/4) silty clay loam (B) that has common fine distinct strong brown (7.5YR 5/8) mottles; very pale brown (10YR 7/3) silty clay loam (A) that has a few fine distinct light brownish gray (10YR 6/2) and brownish yellow (10YR 6/8) mottles; moderate thick platy structure parting to moderate fine subangular blocky; friable; common thin discontinuous dark brown (7.5YR 4/4) clay films; few fine roots; neutral; clear irregular boundary.

B22t—13 to 21 inches; brown (7.5YR 5/4) silty clay; common fine prominent strong brown (7.5YR 5/8) and pinkish gray (7.5YR 6/2) mottles; moderate thick platy structure parting to moderate fine subangular blocky; firm; few fine roots; slightly acid; clear wavy boundary.

B23t—21 to 29 inches; brown (7.5YR 5/4) silty clay; common fine distinct pinkish gray (7.5YR 6/2) and prominent strong brown (7.5YR 5/8) mottles; strong fine angular blocky structure; very firm; few fine roots; neutral; clear wavy boundary.

C1—29 to 33 inches; strong brown (7.5YR 5/6) silty clay; many fine prominent gray (5YR 6/1) and light gray (5YR 7/1) and many fine distinct reddish yellow (7.5YR 6/8) mottles; massive; very firm; strong effervescence; common soft white accumulations of carbonates; mildly alkaline; clear smooth boundary.

C2—33 to 55 inches; brown (7.5YR 5/4) silty clay; common fine prominent gray (10YR 6/1) and common fine distinct strong brown (7.5YR 5/6 and 7.5YR 5/8) mottles; massive; very firm; strong effervescence; common soft white accumulations of carbonates; moderately alkaline; abrupt smooth boundary.

C3—55 to 60 inches; brown (10YR 5/3) silt and very fine sand; common medium faint light brownish gray (10YR 6/2) and common medium prominent brownish yellow (10YR 6/8) mottles; single grained; loose; moderately alkaline.

The thickness of the solum ranges from 24 to 36 inches.

The Ap horizon has value of 3 or 4 and chroma of 1 to 4. It is 7 to 11 inches thick. It is dominantly silt loam but in places is loam.

The B2t horizon has chroma of 3 or 4. It is dominantly silty clay but in places is silty clay loam or clay loam and averages more than 35 percent clay.

The C horizon is stratified silty clay, silt loam, silty clay loam, silt, and very fine sand. Reaction is moderately alkaline to neutral. Some pedons have no stratification in the substratum.

Cohoctah series

The Cohoctah series consists of poorly drained and very poorly drained, moderately rapidly permeable over very rapidly permeable soils on flood plains. These soils formed in loamy over sandy alluvium. Slopes are 0 to 2 percent.

Cohoctah soils are commonly adjacent to Abscota and Sloan soils. Abscota soils are moderately well drained and are sandy throughout the subsoil and substratum. They occupy low knolls, ridges, and flat areas. Sloan soils are finer textured than Cohoctah soils. They are in depressions or drainageways and are very poorly drained.

Typical pedon of Cohoctah fine sandy loam, gravelly substratum, 1,320 feet south and 600 feet east of northwest corner sec. 11, T. 14 N., R. 1 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

C1g—10 to 16 inches; dark gray (10YR 4/1) fine sandy loam; common medium prominent gray (5YR 5/1) and reddish brown (5YR 4/3) mottles; weak fine granular structure; friable; many fine roots; neutral; gradual wavy boundary.

C2g—16 to 25 inches; grayish brown (2.5Y 5/2) fine sandy loam; common medium prominent dark yellowish brown (10YR 3/4) mottles; weak fine subangular blocky structure; friable; neutral; gradual wavy boundary.

C3g—25 to 38 inches; grayish brown (2.5Y 5/2) fine sandy loam; many medium prominent dark reddish brown (5YR 3/4) and common medium prominent dark brown (7.5YR 4/4) mottles; massive; friable; neutral; gradual wavy boundary.

IIC4g—38 to 48 inches; light brownish gray (2.5Y 6/2) gravelly sand; single grained; loose; 15 percent pebbles and cobbles; violent effervescence; moderately alkaline; abrupt wavy boundary.

IIC5g—48 to 60 inches; very dark grayish brown (10YR 3/2) gravelly loamy sand; single grained; loose; 25 percent pebbles and cobbles; strong effervescence; moderately alkaline.

The upper part of the pedon ranges from slightly acid to mildly alkaline. Below a depth of about 30 inches reaction is neutral to moderately alkaline.

The Ap horizon is 5 to 10 inches thick. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly fine sandy loam but in places is loamy sand, sandy loam, or loam.

The Cg horizon has hue of 10YR, 7.5YR or 2.5Y; value of 3 to 6; and chroma of 1 or 2. Some pedons have a buried A horizon or layers containing greater amounts of organic matter than is typical. The Cg horizon is fine sandy loam, sandy loam, or loam. In places it contains thin layers or lenses of loamy fine sand or silt loam.

Covert series

The Covert series consists of moderately well drained, rapidly permeable soils on sandy beach ridges and lake and outwash plains. Slope ranges from 0 to 6 percent.

Covert soils are similar to Oakville soils and are commonly adjacent to Pipestone and Plainfield soils. Oakville soils have a fine sand profile and lack a spodic horizon. Pipestone soils are on foot slopes and in adjacent low areas and are somewhat poorly drained. Plainfield soils lack a spodic horizon, are in the higher areas on ridges and knolls, and are excessively drained.

Typical pedon of Covert sand, 0 to 6 percent slopes, 1,700 feet north and 1,150 feet west of southeast corner sec. 34, T. 16 N., R. 1 W.

A1—0 to 2 inches; black (10YR 2/1) sand; moderate medium granular structure; very friable; many fine roots; very strongly acid; gradual wavy boundary.

A2—2 to 5 inches; light brownish gray (10YR 6/2) sand; moderate medium granular structure; very friable; common fine roots; very strongly acid; clear irregular boundary.

B21ir—5 to 8 inches; dark brown (7.5YR 4/4) sand; moderate fine granular structure; very friable; common fine roots; very strongly acid; gradual irregular boundary.

B22ir—8 to 14 inches; strong brown (7.5YR 5/6) sand; moderate fine granular structure; very friable; few fine roots; strongly acid; gradual irregular boundary.

B23—14 to 19 inches; reddish yellow (7.5YR 6/6) sand; moderate fine granular structure; loose; few fine roots; slightly acid; gradual wavy boundary.

B3—19 to 28 inches; light yellowish brown (10YR 6/4) sand; common medium prominent strong brown (7.5YR 5/6) mottles; single grained; loose; few fine roots; slightly acid; gradual wavy boundary.

C—28 to 60 inches; light yellowish brown (10YR 6/4) sand; common fine prominent reddish yellow (7.5YR 7/8) mottles; single grained; loose; neutral.

The thickness of the solum ranges from 24 to 40 inches.

The A1 horizon has value of 2 to 4 and chroma of 1 or 2. The A2 horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 or 2. Reaction is very strongly acid to slightly acid.

The B horizon has hue of 10YR, 7.5YR, or 5YR; value of 3 to 5; and chroma of 3 to 6. Some pedons have ortstein ranging to as much as 30 percent, by volume, within the B horizon.

The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. Reaction is slightly acid or neutral. Some pedons have a IIC horizon below 40 inches. The IIC horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4. It is silty clay loam or clay loam. Some pedons have strata of silty clay below 40 inches. Reaction in the IIC horizon is slightly acid or neutral.

Ingersoll series

The Ingersoll series consists of somewhat poorly drained, moderately permeable soils. These soils formed in stratified loamy and sandy deposits on lake and outwash plains. Slopes are 0 to 3 percent.

Ingersoll soils are commonly adjacent to Pella and Poseyville soils. Pella soils are in shallow depressions and drainageways and are poorly drained. Poseyville soils have 16 to 24 inches of sand or loamy sand and sandy loam over the loamy material.

Typical pedon of Ingersoll silt loam, 0 to 3 percent slopes, 2,280 feet north and 3,360 feet east of southwest corner sec. 14, T. 16 N., R. 1 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; many fine and medium roots; mildly alkaline; abrupt smooth boundary.

B2t—9 to 12 inches; brown (7.5YR 5/4) silt loam; common medium prominent gray (10YR 5/1) mottles; weak fine angular blocky structure; firm; many fine roots; few dark yellowish brown (10YR 3/4) organic stains; few thin clay films; mildly alkaline; clear wavy boundary.

C1—12 to 15 inches; pale brown (10YR 6/3) silt loam; many medium distinct gray (10YR 5/1) and common medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; many fine roots; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—15 to 30 inches; yellowish brown (10YR 5/4) silt loam and very fine sand; few fine distinct gray (10YR 5/1) and grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; few fine roots; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—30 to 34 inches; pink (5YR 7/3) and light gray (5Y 7/1) stratified silty clay loam and silt loam; massive; friable; many white (10YR 8/1) lime segregations; very few roots; strong effervescence; moderately alkaline; abrupt irregular and broken boundary.

C4—34 to 60 inches; brown (10YR 5/3) silt loam and very fine sand; common medium distinct gray (10YR 5/1) mottles; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 10 to 24 inches.

The Ap horizon has value of 3 or 4. It is dominantly silt loam but in places is fine sandy loam. In some uncultivated areas, the pedon has A1 and A2 horizons.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, chroma of 3 or 4. Texture is dominantly silt loam but in places is fine sandy loam, loam, or light silty clay loam. Reaction is neutral or mildly alkaline.

The C horizon has hue of 10YR to 5YR, 5Y, or 2.5Y; value of 5 to 7; chroma of 1 to 4. It is stratified silt loam, very fine sand, and silty clay loam.

Kingsville series

The Kingsville series consists of poorly drained, rapidly permeable soils on outwash and lake plains. These soils formed in sandy glaciofluvial material. Slopes are 0 to 2 percent. The Kingsville soils in this county have higher reaction than is defined as the range for the series. This difference, however, does not alter the use or behavior characteristics of the soils.

Kingsville soils are commonly adjacent to Covert, Kinross, and Pipestone soils. Covert soils are moderately well drained and have a spodic horizon. They are on knolls and ridges. Kinross soils have a spodic horizon. Pipestone soils are somewhat poorly drained and have a spodic horizon. They occupy low knolls or ridges and slightly higher flat areas.

Typical pedon of Kingsville loamy fine sand, 2,680 feet west and 1,400 feet south of northeast corner sec. 15, T. 16 N., R. 1 W.

O1—3 inches to 0; very dark brown (10YR 2/2) partially decomposed twigs and leaves; massive; friable; abundant roots; medium acid; abrupt smooth boundary.

A1—0 to 6 inches; very dark gray (10YR 3/1) loamy fine sand, dark gray (10YR 4/1) dry; single grained; loose; many roots; medium acid; clear smooth boundary.

C1g—6 to 13 inches; gray (10YR 5/1) fine sand; single grained; loose; medium acid; abrupt wavy boundary.

C2g—13 to 20 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; neutral; gradual wavy boundary.

C3g—20 to 32 inches; gray (10YR 6/1) fine sand; single grained; loose; neutral; gradual wavy boundary.

C4g—32 to 36 inches; brown (7.5YR 5/2) fine sand; common medium prominent yellowish brown (10YR 5/8) and few fine faint gray (10YR 5/1) mottles; single grained; loose; neutral; clear wavy boundary.

C5g—36 to 60 inches; gray (10YR 5/1) fine and very fine sand; weak thin platy structure; very friable; mildly alkaline.

The thickness of the solum is 6 to 24 inches. Reaction is medium acid to moderately alkaline in the solum and slightly acid to moderately alkaline in the substratum.

The A horizon has value of 2 or 3. It is dominantly loamy fine sand but in places is fine sand and loamy sand. It is 3 to 11 inches thick. Some pedons have an Ap or A2 horizon.

Some pedons have a B horizon with hue of 10YR and 5Y, value of 4 to 6, and chroma of 1 to 3. This horizon is sand or fine sand 3 to 21 inches thick.

The C horizon has hue of 10YR, 7.5YR, 5Y, and 2.5Y; value of 5 or 6; and chroma of 1 or 2. It is dominantly fine sand or very fine sand.

Kinross series

The Kinross series consists of poorly drained, very rapidly permeable soils. These soils formed in sandy deposits on lake and outwash plains. Slopes are 0 to 2 percent. The Kinross soils in this county are outside the limits defined as the range for the series because they have a mean annual temperature warmer than 47 degrees F. This difference, however, does not alter the use or behavior characteristics of the soils.

Kinross soils are commonly adjacent to Covert, Kingsville, and Pipestone soils. Covert soils are on the tops of low ridges and knolls and are moderately well drained. Kingsville soils do not have a spodic B horizon. Pipestone soils are on the sides of the low ridges and knolls and are somewhat poorly drained.

Typical pedon of Kinross mucky sand, 220 feet north and 100 feet east of southwest corner sec. 22, T. 15 N., R. 2 W.

Oa—5 inches to 0; black (10YR 2/1) muck; weak fine granular structure; very friable; common fine roots; very strongly acid; clear smooth boundary.

A1—0 to 3 inches; very dark brown (10YR 2/2) mucky sand; weak fine granular structure; very friable; few fine roots; very strongly acid; clear irregular boundary.

A2—3 to 7 inches; dark grayish brown (10YR 4/2) sand; single grained; few fine roots; very strongly acid; clear wavy boundary.

B21ir—7 to 12 inches; dark yellowish brown (10YR 4/4) sand; common fine faint reddish brown (5YR 4/4) and common fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; friable; very strongly acid; gradual wavy boundary.

B22ir—12 to 18 inches; yellowish brown (10YR 5/6) sand; common fine distinct dark brown (10YR 3/3) mottles; weak medium subangular blocky structure; friable; very strongly acid; gradual wavy boundary.

B23ir—18 to 29 inches; dark brown (10YR 4/3) sand; common fine faint dark brown (10YR 3/3) and pale brown (10YR 6/3) mottles; single grained; friable; very strongly acid; clear wavy boundary.

C—29 to 60 inches; yellowish brown (10YR 5/4) sand; common fine distinct yellowish brown (10YR 5/6) and pale brown (10YR 6/3) mottles; single grained; friable; very strongly acid.

The thickness of the solum ranges from 15 to 38 inches. Reaction ranges from medium acid to very strongly acid throughout the profile.

The Oa horizon has hue of 5YR or 10YR. It is 0 to 6 inches thick.

The A1 horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly mucky sand but in places is sand.

The B2ir horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 6. Some pedons have faint or distinct mottling. Some have ortstein, up to 30 percent, within the B2ir horizon. A few pedons have a B2h horizon with hue of 10YR or 5YR and value of 3 or 4.

The C horizon has chroma of 3 or 4.

Lenawee series

The Lenawee series consists of poorly drained and very poorly drained, moderately slowly permeable soils on lake plains. These soils formed in clayey or loamy lacustrine deposits. Slopes are 0 to 2 percent.

Lenawee soils are commonly adjacent to Wixom, Bowers, and Belleville soils. The somewhat poorly drained Wixom soils formed in 20 to 40 inches of sand over loamy material. They occupy low ridges and slightly convex areas. The somewhat poorly drained Bowers soils occupy slightly higher positions on the landscape. Belleville soils have a coarser textured subsoil than Lenawee soils.

Typical pedon of Lenawee silty clay loam, 2,340 feet east and 100 feet north of southwest corner sec. 9, T. 15 N., R. 2 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; moderate fine granular structure; firm; few fine roots; slightly acid; abrupt smooth boundary.

B21g—9 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine prominent yellowish brown (7.5YR 5/6, 5/8) mottles; moderate medium angular blocky structure; firm; few fine roots; slightly acid; clear wavy boundary.

B22g—18 to 25 inches; light brownish gray (10YR 6/2) silty clay; common medium prominent strong brown (7.5YR 5/6, 5/8) mottles; moderate medium angular blocky structure; firm; neutral; gradual wavy boundary.

B23g—25 to 40 inches; grayish brown (10YR 5/2) silty clay; common fine faint light brownish gray (10YR 6/2) and common medium prominent strong brown (7.5YR 5/6, 5/8) mottles; massive; very firm; medium acid; clear wavy boundary.

C1g—40 to 46 inches; reddish gray (5YR 5/2) silty clay; common fine prominent light brownish gray (2.5Y 6/2), strong brown (7.5YR 5/6), and reddish yellow (7.5YR 6/8) mottles; massive; very firm; slight effervescence; mildly alkaline; clear wavy boundary.

C2g—46 to 52 inches; reddish brown (5YR 5/3) silty clay; common fine prominent grayish brown (2.5Y 5/2) and common medium prominent strong brown (7.5YR 5/6) mottles; massive; very firm; strong effervescence; moderately alkaline; clear wavy boundary.

C3g—52 to 60 inches; grayish brown (2.5Y 5/2) silty clay; common medium prominent reddish brown (5YR 5/4) and reddish yellow (5YR 6/6, 6/8) mottles; massive; very firm; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 50 inches. The solum ranges from medium acid to neutral in the A and B21g horizons and from slightly acid to mildly alkaline in the lower part of the B horizon. The clay content in the control section averages between 35 and 45 percent.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silty clay loam but in places is silt loam and loam. Some pedons have an A2 horizon.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silty clay and contains thin layers of silt loam, clay, or very fine sand. Some pedons have a B1 horizon.

The C horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 2 to 6. It is stratified silt loam to silty clay. Reaction is mildly alkaline or moderately alkaline.

Londo series

The Londo series consists of somewhat poorly drained, moderately permeable or moderately slowly permeable soils. These soils formed in loamy, calcareous till on till plains. Slopes are 0 to 3 percent.

Londo soils are commonly adjacent to Parkhill, Poseyville, and Wixom soils. Parkhill soils are in shallow depressions and drainageways and are poorly drained or very poorly drained. Poseyville soils have 16 to 24 inches of sand and sandy loam over the loam subsoil. Wixom soils have 20 to 40 inches of sand over the loam subsoil.

Typical pedon of Londo loam, 0 to 3 percent slopes, 200 feet north and 100 feet west of southeast corner sec. 36, T. 13 N., R. 2 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, gray (10YR 6/1) dry; weak medium granular structure; friable; many roots; neutral; abrupt smooth boundary.

B&A—9 to 14 inches; brown (10YR 4/3) loam (B) that has common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/4) mottles and weak fine subangular blocky structure; pale brown (10YR 6/3) loam (A) that has weak fine angular blocky structure; thin discontinuous vertical tongues and thick coatings on all ped faces, root channels, and vertical cracks; common fine organic stains; firm; continuous thin grayish brown (10YR 5/2) clay films on faces of peds; many roots; mildly alkaline; gradual wavy boundary.

B2t—14 to 19 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct gray (10YR 5/1) and common medium prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; few roots; continuous thin grayish brown (10YR 5/2) clay films on faces of peds; strong effervescence; mildly alkaline; gradual wavy boundary.

C—19 to 60 inches; gray (10YR 5/1) loam; common medium faint yellowish brown (10YR 5/2) mottles; massive; firm; 10 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 12 to 25 inches.

The Ap horizon has value of 3 or 4 (5 or 6 dry) and chroma of 1 or 2. It is dominantly loam but in places is fine sandy loam or silt loam. Reaction is slightly acid to mildly alkaline. Some undisturbed pedons have A1 and A2 horizons.

The A part of the B&A horizon has chroma of 2 or 3. It is dominantly loam but in places is fine sandy loam or silt loam. The B part has chroma of 3 or 4. It is loam or clay loam and is neutral or mildly alkaline.

The B2t horizon has chroma of 3 or 4. It is loam or clay loam.

The C horizon has chroma of 3 or 4. It is loam or clay loam and has slight to strong effervescence.

Menominee series

The Menominee series consists of moderately well drained, rapidly permeable over moderately slowly permeable soils. These soils formed in 20 to 40 inches of sand over loamy material on outwash and lake plains. Slopes range from 2 to 6 percent. The Menominee soils in this county are outside the limits defined as the range for the series because they have a mean annual temperature warmer than 47 degrees F. This difference, however, does not alter the use or behavior characteristics of the soils.

Menominee soils are commonly adjacent to Belleville, Kingsville, and Wixom soils. Belleville soils are in shallow depressions and drainageways and are very poorly drained or poorly drained. Kingsville soils have a sand layer more than 40 inches thick. They are in shallow depressions and drainageways and are poorly drained. Wixom soils are on foot slopes of low knolls and are somewhat poorly drained.

Typical pedon of Menominee sand, 2 to 6 percent slopes, 700 feet east and 900 feet south of northwest corner sec. 1, T. 16 N., R. 1 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) sand, light brownish gray (10YR 6/2) dry; single grained; loose; many fine roots; medium acid; abrupt smooth boundary.

A2—6 to 8 inches; pinkish gray (7.5YR 6/2) sand; single grained; 5 percent coarse fragments by volume; medium acid; abrupt wavy boundary.

B21ir—8 to 13 inches; dark brown (7.5YR 4/4) sand; single grained; loose; 8 percent coarse fragments by volume; slightly acid; abrupt wavy boundary.

B22ir—13 to 20 inches; strong brown (7.5YR 5/6) sand; single grained; loose; 8 percent coarse fragments by volume; slightly acid; gradual wavy boundary.

B3—20 to 26 inches; brown (7.5YR 5/4) sand; single grained; loose; 8 percent coarse fragments by volume; slightly acid; clear wavy boundary.

IIBt—26 to 30 inches; reddish brown (5YR 5/4) silty clay loam; few fine prominent gray (10YR 6/1) and yellowish brown (10YR 5/8) mottles; weak medium angular blocky structure; firm; many thick discontinuous reddish brown (5YR 4/4) clay films; neutral; gradual wavy boundary.

IIC—30 to 60 inches; reddish brown (5YR 5/4) silty clay loam; few fine prominent yellowish brown (10YR 5/8) and gray (10YR 5/1) mottles; massive; firm; few fine light gray (10YR 7/2) lime concretions; slight effervescence; moderately alkaline.

The depth to the IIBt horizon ranges from 20 to 40 inches. The soil is 1 to 10 percent pebbles and cobbles, by volume, throughout. Reaction in the sandy part of the solum ranges from strongly acid to slightly acid.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly sand but in places is loamy sand. Undisturbed pedons have A1 and A2 horizons. A 6- to 12-inch A2 horizon occurs in some pedons where the plow layer is less than 7 inches thick.

The B21ir horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 2 to 4. Some pedons have a Bh horizon above the B21ir horizon. Some have chunks of ortstein in the Bir horizon. Some have an A'2 horizon.

The texture of the IIBt and IIC horizons is dominantly silty clay loam but in places is clay loam, loam, or silt loam. Reaction ranges from medium acid to moderately alkaline.

Oakville series

The Oakville series consists of moderately well drained, very rapidly permeable soils on sandy beach ridges and outwash plains. These soils formed in sandy material. Slopes range from 0 to 6 percent.

Oakville soils are commonly adjacent to Kingsville and Pipestone soils. Kingsville soils are in shallow depressions and drainageways and are poorly drained. Pipestone soils are somewhat poorly drained and have spodic development. They occupy the sides of low knolls and ridges and the slightly lower broad flat areas.

Typical pedon of Oakville fine sand, 0 to 6 percent slopes, 1,100 feet south and 70 feet west of northeast corner sec. 10, T. 16 N., R. 1 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sand, light brownish gray (10YR 6/2) dry; single grained; loose; many roots; medium acid; abrupt smooth boundary.

A2—7 to 14 inches; light brownish gray (10YR 6/2) fine sand; single grained; loose; few roots; slightly acid; clear wavy boundary.

B21—14 to 20 inches; dark brown (7.5YR 4/4) fine sand; single grained; loose; neutral; abrupt wavy boundary.

B22—20 to 25 inches; brown (7.5YR 5/4) fine sand; single grained; loose; neutral; gradual wavy boundary.

B3—25 to 30 inches; brown (10YR 5/3) fine sand; common medium prominent yellowish brown (10YR 5/8) mottles; single grained; loose; neutral; gradual wavy boundary.

C—30 to 60 inches; pale brown (10YR 6/3) fine sand; common medium prominent strong brown (7.5YR 5/8) and common medium distinct yellowish brown (10YR 5/6) mottles; single grained; loose; neutral.

The thickness of the solum ranges from 20 to 40 inches. Reaction of the profile ranges from medium acid to neutral.

The Ap horizon has chroma of 2 or 3. The A2 horizon has chroma of 1 or 2. Some uncultivated pedons have an A1 horizon.

Some pedons have a B1 horizon. The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. The B3 horizon has value of 5 or 6 and chroma of 3 or 4.

The C horizon has value of 5 or 6 and chroma of 2 or 3.

Parkhill series

The Parkhill series consists of poorly drained and very poorly drained, moderately slowly permeable soils on till plains. These soils formed in loamy glacial till. Slopes are 0 to 2 percent.

Parkhill soils are commonly adjacent to Belleville, Londo, and Poseyville soils. Belleville soils are coarser textured than Parkhill soils in the upper part of the solum. They are in low areas and drainageways. Londo soils are in slightly higher level and nearly level areas and are somewhat poorly drained. Poseyville soils also are somewhat poorly drained. They occupy low knolls and nearly level areas.

Typical pedon of Parkhill loam, 1,400 feet east and 190 feet south of northwest corner sec. 22, T. 13 N., R. 1 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; many fine roots; 5 percent pebbles; neutral; abrupt smooth boundary.

B21g—8 to 14 inches; grayish brown (2.5Y 5/2) loam; common medium prominent yellowish brown (10YR 5/8) mottles; moderate fine angular blocky structure; friable; many fine roots; 5 percent pebbles; neutral; gradual wavy boundary.

B22g—14 to 25 inches; gray (10YR 5/1) loam; common medium distinct dark brown (10YR 4/3) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; friable; few fine roots; 10 percent pebbles and cobbles; neutral; gradual wavy boundary.

C1g—25 to 30 inches; gray (10YR 5/1) loam; common coarse distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; friable; 10 percent pebbles and cobbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—30 to 60 inches; grayish brown (10YR 5/2) loam; common medium distinct gray (10YR 5/1) and common medium prominent strong brown (7.5YR 5/6) mottles; massive; friable; 10 percent pebbles and cobbles; strong effervescence; moderately alkaline.

The thickness of the solum is 20 to 44 inches. Reaction in the solum is slightly acid to neutral. The subsoil is loam or clay loam, and the substratum loam or silt loam.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have an A2g horizon. The B2g horizon has value of 5 or 6 and chroma of 1 or 2. The C horizon has value of 4 to 6 and chroma of 1 or 2.

Pella series

The Pella series consists of poorly drained, moderately permeable soils on lake plains. These soils formed in silty glaciolacustrine deposits. Slopes are 0 to 2 percent. The Pella soils in this county have a thinner solum than is defined as the range for the series. This difference, however, does not alter the use or behavior characteristics of the soil.

Pella soils are commonly adjacent to Ingersoll, Lenawee, Pipestone, and Wixom soils. Ingersoll soils are in broad flat areas and are somewhat poorly drained. Lenawee soils occupy low broad flats and depressions and are poorly drained and very poorly drained. Pipestone soils are sandy throughout. They occupy flat areas, low ridges, and side slopes and are somewhat poorly drained. Wixom soils also are somewhat poorly drained. They are in flat areas and on low knolls and ridges.

Typical pedon of Pella silt loam, 2,500 feet north and 25 feet east of southwest corner sec. 15, T. 16 N., R. 1 E.

A1—0 to 12 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; many roots; neutral; abrupt wavy boundary.

B21g—12 to 15 inches; olive gray (5Y 5/2) silt loam; common medium prominent very dark brown (10YR 2/2) stains; weak coarse subangular blocky structure; very friable; mildly alkaline; clear wavy boundary.

B22g—15 to 20 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent light olive brown (2.5Y 5/6) mottles; moderate medium angular blocky structure; firm; mildly alkaline; gradual wavy boundary.

C1—20 to 30 inches; olive (5Y 5/3) silty clay loam; many medium prominent light olive brown (2.5Y 5/6) mottles; massive; friable; violent effervescence; moderately alkaline; clear smooth boundary.

IIC2g—30 to 60 inches; grayish brown (10YR 5/2) silt loam and very fine sand; many medium prominent yellowish brown (10YR 5/8 and 5/6) mottles; massive; friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 17 to 23 inches. Reaction in the solum is neutral to moderately alkaline. The mollic epipedon ranges from 9 to 12 inches in thickness.

The Bg horizon has hue of 10YR, 2.5Y, and 5Y and value of 5 to 7. It is dominantly silt loam or silty clay loam but in places is sandy loam, loam, or very fine sandy loam.

The C horizon has hue of 7.5YR, 10YR, 2.5Y, or 5Y; value of 4 to 7; and chroma of 1 to 8. The IIC horizon is stratified very fine sand, silt loam, sandy loam, loam, or silty clay loam. The substratum is mildly to moderately alkaline.

Pipestone series

The Pipestone series consists of somewhat poorly drained soils that are rapidly permeable or rapidly permeable over moderately slowly or slowly permeable. These soils formed in sandy deposits on beach ridges and lake and outwash plains. Slopes are 0 to 3 percent.

Pipestone soils are commonly adjacent to Covert, Kingsville, and Kinross soils. Covert soils occupy the higher areas on ridges and knolls and are moderately well drained. Kingsville and Kinross soils are in shallow depressions and drainageways and are poorly drained.

Typical pedon of Pipestone sand, 0 to 3 percent slopes, 1,300 feet north and 300 feet west of southeast corner sec. 34, T. 16 N., R. 1 W.

A1—0 to 2 inches; black (10YR 2/1) sand; weak fine granular structure; very friable; many fine and few medium roots; very strongly acid; abrupt smooth boundary.

A2—2 to 6 inches; grayish brown (10YR 5/2) sand; few fine prominent yellowish brown (10YR 5/6) mottles; weak fine granular structure; very friable; common fine and few medium roots; very strongly acid; abrupt irregular boundary.

B2ir—6 to 13 inches; yellowish brown (10YR 5/6) sand; common fine prominent yellowish red (5YR 4/8) and common medium prominent reddish brown (5YR 4/4) mottles; weak medium subangular blocky structure; very friable; common fine and few medium roots; very strongly acid; gradual wavy boundary.

B22ir—13 to 18 inches; yellowish brown (10YR 5/8) sand; common few prominent dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; very friable; few fine roots; strongly acid; gradual wavy boundary.

B3—18 to 24 inches; brownish yellow (10YR 6/6) sand; common fine prominent yellowish red (5YR 4/8) mottles; single grained; loose; few fine roots; strongly acid; clear smooth boundary.

C1—24 to 38 inches; yellow (10YR 7/6) sand; common fine distinct strong brown (7.5YR 5/6) mottles; single grained; loose; strongly acid; abrupt smooth boundary.

C2—38 to 60 inches; brownish yellow (10YR 6/6) sand; many medium prominent strong brown (7.5YR 5/8) and yellowish red (5YR 5/8) mottles; single grained; loose; medium acid.

The thickness of the solum ranges from 20 to 42 inches. Reaction ranges from very strongly acid to slightly acid.

The A1 horizon has value of 2 to 4 and chroma of 1 or 2. It is dominantly sand but in places is fine sand. Cultivated pedons have an Ap horizon. Some undisturbed pedons have a 01 surface layer. The A2 horizon has value of 5 or 6, chroma of 1 or 2, and faint to prominent mottles. It is sand or fine sand.

The B2ir horizon has hue of 10YR, 7.5YR, or 5YR; value of 2 to 5; and chroma of 2 to 8. It is sand or fine sand. A few pedons have ortstein, up to 50 percent, within the B2ir horizon.

The C horizon has value of 5 to 7 and chroma of 2 to 6. The texture is sand or fine sand. Reaction ranges from very strongly acid to neutral. Some pedons have a IIC horizon at a depth of 40 to 60 inches. The IIC horizon has hue of 7.5YR or 5YR, value of 5 or 6, and chroma of 2 to 4. The texture is clay loam, loam, or silty clay loam. Reaction is mildly to moderately alkaline.

Plainfield series

The Plainfield series consists of excessively drained, rapidly permeable soils on old beach ridges and outwash and lake plains. These soils formed in sandy material. Slopes range from 0 to 6 percent.

Plainfield soils are commonly adjacent to Covert, Kingsville, and Pipestone soils. Covert soils are moderately well drained, are sandy throughout the pedon, and have spodic horizons. They are lower on the landscape than Plainfield soils but in similar positions. Kingsville soils are poorly drained and are sandy throughout the pedon. They occupy broad flats, shallow depressions, and drainageways. Pipestone soils are somewhat poorly drained, are sandy throughout the pedon, and have spodic horizons. They are on low knolls, ridges, and side slopes.

Typical pedon of Plainfield sand, 0 to 6 percent slopes, 1,550 feet north and 150 feet west of southeast corner sec. 34, T. 16 N., R. 1 W.

A1—0 to 4 inches; very dark brown (10YR 2/2) sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common fine roots; strongly acid; abrupt wavy boundary.

A2—4 to 6 inches; grayish brown (10YR 5/2) sand; very weak fine granular structure; very friable; common fine roots; strongly acid; abrupt wavy boundary.

B2—6 to 20 inches; strong brown (7.5YR 5/6) sand; weak coarse granular structure; very friable; common fine roots; strongly acid; gradual wavy boundary.

B3—20 to 25 inches; reddish yellow (7.5YR 6/6) sand; single grained; loose; few fine roots; strongly acid; abrupt wavy boundary.

C—25 to 60 inches; light yellowish brown (10YR 6/4) sand; single grained; loose; medium acid.

The thickness of the solum is 24 to 34 inches. Reaction in the solum is very strongly acid to medium acid. Reaction in the C horizon is strongly acid to medium acid.

The A1 horizon has value of 2, 3, or 4. The A2 horizon has hue of 10YR, value of 5 to 7, and chroma of 0 to 3. The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 6. The C horizon has value of 5 or 6 and chroma of 4 to 6.

Poseyville series

The Poseyville series consists of somewhat poorly drained, rapidly permeable over moderately or moderately slowly permeable soils on till and lake plains. These soils formed in sandy material less than 24 inches thick over loamy glacial till or lacustrine material. Slopes range from 0 to 4 percent.

Poseyville soils are commonly adjacent to Parkhill, Pipestone loamy substratum, and Wixom soils. They are mapped only with Londo soils. Parkhill soils are finer textured throughout the pedon than Poseyville soils. They are in narrow drainageways and are poorly drained and very poorly drained. Pipestone loamy substratum soils lack argillic horizons and have more than 40 inches of sand. Wixom soils have spodic horizons and thicker sandy deposits. Londo soils are loamy throughout.

Typical pedon of Poseyville loamy sand in an area of Poseyville-Londo complex, 0 to 4 percent slopes, 2,200 feet east and 200 feet north of southwest corner sec. 32, T. 16 N., R. 2 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, gray (10YR 5/1) dry; moderate fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

A2—9 to 16 inches; brown (10YR 5/3) sand; many coarse distinct yellowish brown (10YR 5/6) mottles; single grained; loose; many fine roots; neutral; abrupt smooth boundary.

B21t—16 to 21 inches; yellowish brown (10YR 5/4) sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; weak medium angular blocky structure; friable; common fine roots; mildly alkaline; gradual wavy boundary.

B22t—21 to 23 inches; brown (10YR 4/3) sandy loam; common medium distinct grayish brown (10YR 5/2), brownish yellow (10YR 6/8), and yellowish brown (10YR 5/6) mottles; moderate coarse platy structure parting to moderate fine angular blocky; friable; few fine roots; mildly alkaline; abrupt wavy boundary.

IIC—23 to 60 inches; gray (10YR 5/1) loam; moderate medium prominent yellowish brown (10YR 5/8) and moderate medium faint grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; slight effervescence; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 16 to 24 inches. The solum ranges from medium acid to mildly alkaline. Thickness of the mollic epipedon ranges from 8 to 11 inches.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy sand but in places is sand. The A2 horizon has value of 5 or 6 and chroma of 2 or 3. It is loamy sand or sand.

The B2 horizon has value of 4 to 6 and chroma of 2 to 6. It is loamy sand or sandy loam.

The IIC horizon has value of 4 or 5 and chroma of 1 or 6. Texture is dominantly loam, but in places is clay loam or silty clay loam. Reaction is mildly alkaline or moderately alkaline.

Sloan series

The Sloan series consists of very poorly drained, moderately or moderately slowly permeable soils on flood plains. These soils formed in recent loamy alluvial material. Slopes are 0 to 2 percent.

Sloan soils are commonly adjacent to Abscota and Cohoctah soils. Abscota soils are sandy. They occupy low knolls, ridges, and flat areas and are moderately well drained. Cohoctah soils have coarser textured pedons than Sloan soils. They are in higher areas of the drainageways and are poorly drained and very poorly drained.

Typical pedon of Sloan loam, 1,100 feet south and 100 feet east of northwest corner sec. 25, T. 15 N., R. 1 W.

A1—0 to 12 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.

B21g—12 to 19 inches; dark gray (10YR 4/1) loam; common medium distinct dark brown (10YR 4/3) and few medium prominent yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure parting to weak fine granular; friable; common fine and medium roots; neutral; gradual wavy boundary.

B22g—19 to 30 inches; gray (10YR 5/1) loam; common medium prominent dark brown (7.5YR 4/4) mottles; weak medium angular blocky structure; friable; few fine and medium roots; neutral; gradual wavy boundary.

B23g—30 to 40 inches; gray (10YR 5/1) clay loam; many medium distinct brown (10YR 5/3) and many medium prominent yellowish brown (10YR 5/8) and light yellowish brown (10YR 6/4) mottles; moderate fine angular blocky structure; firm; mildly alkaline; gradual wavy boundary.

IIC1g—40 to 51 inches; gray (10YR 5/1) sandy loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; 10 percent pebbles and cobbles; slight effervescence; moderately alkaline; clear wavy boundary.

IIIC2g—51 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; massive; firm; 10 percent pebbles and cobbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 40 inches. Reaction in the solum is neutral to mildly alkaline and in the C horizon neutral to moderately alkaline. Texture of the surface layer and subsoil is dominantly loam but in places is clay loam. The C horizon is stratified coarse sandy loam or silty clay loam and other varying textures.

Wauseon series

The Wauseon series consists of poorly drained, rapidly permeable over very slowly permeable soils on till and lake plains. These soils formed in 20 to 40 inches of sandy or loamy material over clayey deposits. Slopes are 0 to 2 percent. The Wauseon soils in this county are taxadjuncts to the Wauseon series because the mollic epipedon is thinner than is defined as the range for Mollisols. This difference, however, does not alter the use or behavior characteristics of the soils.

Wauseon soils are commonly adjacent to Wixom, Pipestone loamy substratum, and Belleville soils. Wixom soils are sandy over loamy, are on low knolls and ridges, and are somewhat poorly drained. Pipestone loamy substratum soils have 40 to 60 inches of sand over loamy deposits. They are on low knolls and ridges and are somewhat poorly drained. Belleville soils have a coarser textured pedon than Wauseon soil. They are in low flat areas.

Typical pedon of Wauseon sandy loam, 2,580 feet south and 750 feet east of northwest corner sec. 25, T. 15 N., R. 1 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21g—8 to 16 inches; dark gray (10YR 4/1) sandy loam; black (10YR 2/1) organic stains; weak coarse subangular blocky structure; friable; many fine roots; neutral; abrupt wavy boundary.

B22g—16 to 35 inches; light olive gray (5Y 6/2) sandy loam; common medium prominent yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; neutral; gradual wavy boundary.

IICg—35 to 60 inches; gray (5Y 5/1) and olive (5Y 5/4) silty clay; massive; very firm; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 40 inches. The horizons above the IIC horizon are sandy loam or loamy sand. Reaction is strongly acid or medium acid. The IIC horizon is silty clay or clay, and reaction ranges from neutral to moderately alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is 6 to 9 inches thick. Some pedons have an A1 horizon. The B2g horizon has hue of 10YR or 5Y, value of 3 to 6, and chroma of 1 or 2. The IICg horizon has hue of 5Y or 10YR and chroma of 1 or 4. Some pedons have thin lenses of silt, sand, and fine gravel in the substratum.

Wixom series

The Wixom series consists of somewhat poorly drained, rapidly permeable over moderately slowly permeable soils on till and lake plains. These soils formed in 20 to 40 inches of sandy material over loamy glacial till or lacustrine deposits. Slopes are 0 to 3 percent.

Wixom soils are commonly adjacent to Belleville, Parkhill, and Pipestone loamy substratum soils. Belleville soils lack spodic horizons, are in narrow drainageways and depressions, and are poorly drained and very poorly drained. Parkhill soils are finer textured than Wixom soils. They occupy foot slopes and narrow drainageways and depressions. They are poorly drained and very poorly drained. Pipestone loamy substratum soils have 40 to 60 inches of sand over loamy deposits. They are on low knolls and ridges.

Typical pedon of Wixom loamy sand, 0 to 3 percent slopes, 700 feet south and 260 feet west of northeast corner sec. 9, T. 16 N., R. 1 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary.

A2—9 to 14 inches; grayish brown (10YR 5/2) fine sand; single grained; loose; many fine roots; slightly acid; abrupt wavy boundary.

B2ir—14 to 22 inches; dark yellowish brown (10YR 4/4) fine sand; few fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak fine subangular blocky structure; friable; common fine roots; slightly acid; gradual wavy boundary.

A'2—22 to 29 inches; pale brown (10YR 6/3) fine sand; common medium distinct yellowish brown (10YR 5/6) and light gray (10YR 7/1) mottles; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; abrupt wavy boundary.

IIB'2t—29 to 34 inches; brown (7.5YR 4/4) sandy clay loam; few fine faint pinkish gray (7.5YR 6/2) and common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium angular blocky structure; firm; few fine roots; neutral; abrupt smooth boundary.

IIC—34 to 60 inches; reddish brown (5YR 4/4) silty clay loam; common medium distinct yellowish red (5YR 5/6 and 5/8) and light reddish brown (5YR 6/4) mottles; massive; firm; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 45 inches, and the depth to the IIB2't horizon ranges from 23 to 40 inches. The sandy part of the solum ranges from strongly acid to neutral.

The Ap horizon is 7 to 11 inches thick. It has value of 3 or 4 and chroma of 1 or 2. The A2 horizon has value of 5 to 7 and chroma of 1 or 2. The A horizon is dominantly loamy sand but in places is fine sand or sand.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is dominantly fine sand but in places is loamy sand or sand. Some pedons have a B1, B3, or Bh horizon. In places the B horizon is 5 to 15 percent ortstein by volume. The A'2 horizon has value of 5 or 6 and chroma of 2 to 4. It is fine sand or sand. The IIB'2t horizon has hue of 7.5YR, 10YR, and 5YR; value of 4 or 5; and chroma of 2 to 4. The texture is dominantly sandy clay loam but in places is silty clay loam, loam, or clay loam. Reaction is neutral to mildly alkaline.

The IIC horizon has hue of 5YR, 7.5YR, and 10YR; value of 4 to 6; and chroma of 1 to 4. The texture is dominantly silty clay loam but in places is clay loam or loam. Reaction is moderately alkaline to mildly alkaline. Some pedons have strata of silty clay or clay.

Formation of the soils

The following paragraphs describe the factors of soil formation and relate them to the formation of soils in Midland County. They also explain the processes of soil formation.

Factors of soil formation

Soil forms through the interaction of five major factors: (1) the physical, chemical, and mineral composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the processes of soil formation have acted on the parent material (*3*).

Climate and plant and animal life are the active forces in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be a long or a short time, but some time is required for differentiation of soil horizons. Generally, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent material

Parent material is the unconsolidated mass from which a soil forms. The parent materials of the soils of Midland County were deposited by glaciers or by melt water from the glaciers. Some of these materials were subsequently reworked and redeposited by water and wind. Parent material determines the limits of the chemical and mineralogical composition of the soil. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Midland County were deposited as outwash material, lacustrine materials, alluvium, glacial till, and organic material.

Outwash material is deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to the speed of the stream that carried them. When the water slows down, the coarser particles are deposited. Finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sand, gravel, and other coarse particles. The Covert soils, for example, formed in deposits of outwash material.

Lacustrine material is deposited from still, or ponded, glacial melt water. Because the coarser fragments drop out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remain to settle out in still water. In Midland County, soils formed in lacustrine deposits are typically medium textured and moderately fine textured. Pella soils, for example, formed in lacustrine material.

Alluvium is deposited by floodwaters of present streams in recent time. The texture of this material depends on the speed of the water from which it was deposited. The alluvium deposited along a swift stream is coarser textured than that deposited along a slow, sluggish stream. Cohoctah and Sloan soils, for example, are alluvial soils.

Glacial till is material laid down directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water washing. The glacial till is loam, silt loam, silty clay loam, clay loam, silty clay, or clay. Parkhill soils, for example, formed in glacial till. Typically they are medium textured and have well developed structure.

Organic material is a deposit of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in outwash plains, lake plains, and till plains. As the grasses and sedges growing around the edges of these lakes died, the plant remains did not decompose but remained around the edges of the lakes. Later, water-tolerant trees grew on the areas. As these trees died, their residue became a part of the organic accumulation. In this way, the lakes were eventually filled with organic material and developed into areas of muck. Adrian soils, for example, formed in organic material.

Plant and animal life

Plants have been the principal organisms influencing the soils in Midland County. Bacteria, fungi, earthworms, and the activities of man have also been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds of plants that grew on the soil. The remains of these plants accumulate on the surface, decay, and eventually become organic matter. Roots of the plants provide channels for downward movement of water through the soil and also add organic matter as they decay. Bacteria in the soil help to break down the organic matter so that it can be used by growing plants.

The vegetation in Midland County was mainly deciduous forest. Differences in natural soil drainage and minor changes in parent material affected the composition of the forest species.

In general, the moderately well drained upland soils, such as Menominee soils, were covered mostly with aspen and red oak. The Oakville soils were covered with scrub oak. The wet soils were covered mainly with soft maple and ash. The Kingsville and Kinross soils, which formed under wet conditions, contain a considerable amount of organic matter.

Climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil, and it determines the amount of water available for the weathering of minerals and the transporting of soil material. Climate, through its influence on temperatures in the soil, determines the rate of chemical reaction that occurs in the soil. These influences are important but affect large areas rather than small areas, such as a county.

The climate in Midland County is temperate continental. It is presumably similar to the climate that existed when the soils formed. The soils in Midland County differ from soils formed in a dry, warm climate or from those formed in a hot, moist climate. Climate is uniform throughout the county.

Relief

Relief, or topography, has affected the soils of Midland County through its influence on natural drainage, erosion, plant cover, and soil temperature. Slopes range from 0 to 6 percent. There are a few very steep escarpments. Natural soil drainage ranges from excessively drained on the ridgetops to very poorly drained in the depressions.

Relief influences the formation of soils by affecting runoff and drainage. Drainage in turn, through its effect on aeration of the soil, determines the color of the soil. In low areas, water is temporarily ponded. Water and air move freely through soils that are well drained but slowly through soils that are very poorly drained. In soils that are well aerated, the iron and aluminum compounds that give most soils their color are oxidized, and the soils are brightly colored. Poorly aerated soils are dull gray and mottled. Plainfield soils are examples of excessively drained, well aerated soils. Kinross soils are examples of poorly drained, poorly aerated soils. All formed in similar parent material.

Time

Time, generally a long time, is needed for development of distinct horizons from the parent material. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly, others slowly.

The soils in Midland County range from young to mature. The glacial deposits in which many of the soils of Midland County formed have been exposed to soil-forming factors for a long enough time that distinct horizons have developed. Some soils forming in recent alluvial sediments have not been in place long enough for the development of distinct horizons.

Sloan soils are examples of young soils formed in alluvial material. Parkhill and Bowers soils are more mature. Horizons are more clearly expressed because a large proportion of the lime has been leached out.

Genesis and morphology

Soil genesis is the process through which soil horizons develop from the unconsolidated parent material. Soil morphology is the study of the physical, chemical, and biological properties of these various soil horizons.

Several processes were involved in the development of soil horizons in the soils of Midland County: (1) accumulation of organic matter, (2) leaching of lime (calcium carbonates) and other bases, (3) reduction and transfer of iron, and (4) formation and translocation of clay minerals. In most soils more than one of these processes has been active in the development of the horizons.

Organic matter accumulates at the surface to form an A1 horizon. The A1 horizon is mixed into a plow layer (Ap) when the soil is plowed. In soils of Midland County, the surface layer ranges from high to low in organic-matter content. Kinross soils, for example, have a high organic-matter content in the surface layer, and Plainfield soils a low organic-matter content.

Leaching of carbonates and other bases has occurred in most of the soils. Soil scientists generally agree that leaching of bases in soils usually precedes the translocation of clay minerals. Many of the soils are moderately to strongly leached. For example, Parkhill soils are leached of carbonates to a depth of 20 to 45 inches, whereas Poseyville soils are leached to a depth of only 13 to 24 inches. Differences in the depth of leaching are a result of time as a soil-forming factor.

The reduction and transfer of iron, a process called gleying, is evident in the somewhat poorly drained, poorly drained, and very poorly drained soils. The gray color in the subsoil indicates the reduction and loss of iron. Belleville soils are examples of soils in which the gleying and reduction processes are evident.

Leaching of bases and translocation of clays are among the more important processes that result in horizon differentiation in soils. In some soils the translocation of clay minerals has contributed to horizon development. Such soils were probably leached of carbonates and soluble salts to a considerable extent before translocation of clay took place. The eluviated, or leached, A2 horizon above the illuviated B horizon has a platy structure, is lower in content of clay, and typically is lighter in color. The B horizon typically has an accumulation of clay (clay films) in pores and on ped surfaces. The Bowers soil is an example of a soil having translocated clays in the form of clay films accumulated in the B horizon.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Jenny, Hans. 1941. Factors of soil formation. McGraw-Hill Book Company, Inc., 281 pp., illus.

(4) Michigan State University. 1970. Fertilizer recommendations for vegetables and field crops in Michigan. Ext. Bull. E-550, 24 pp.

(5) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(6) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(7) United States Department of Agriculture. 1975. Soil taxonomy. A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Service, U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Congeliturbate. Soil material disturbed by frost action.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse* more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Soil scientists regard as soil only the part of the regolith that is modified by organisms and other soil-building forces. Most engineers describe the whole regolith, even to a great depth, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-alumina ratio. The molecular ratio of silica to alumina in soil, clay, or any alumino-silicate mineral.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements in soils, in only extremely small amounts, essential to plant growth. Examples are zinc, cobalt, manganese, copper, and iron.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within 1 year; specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in a glacial lake or other body of still water in front of a glacier.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Illustrations

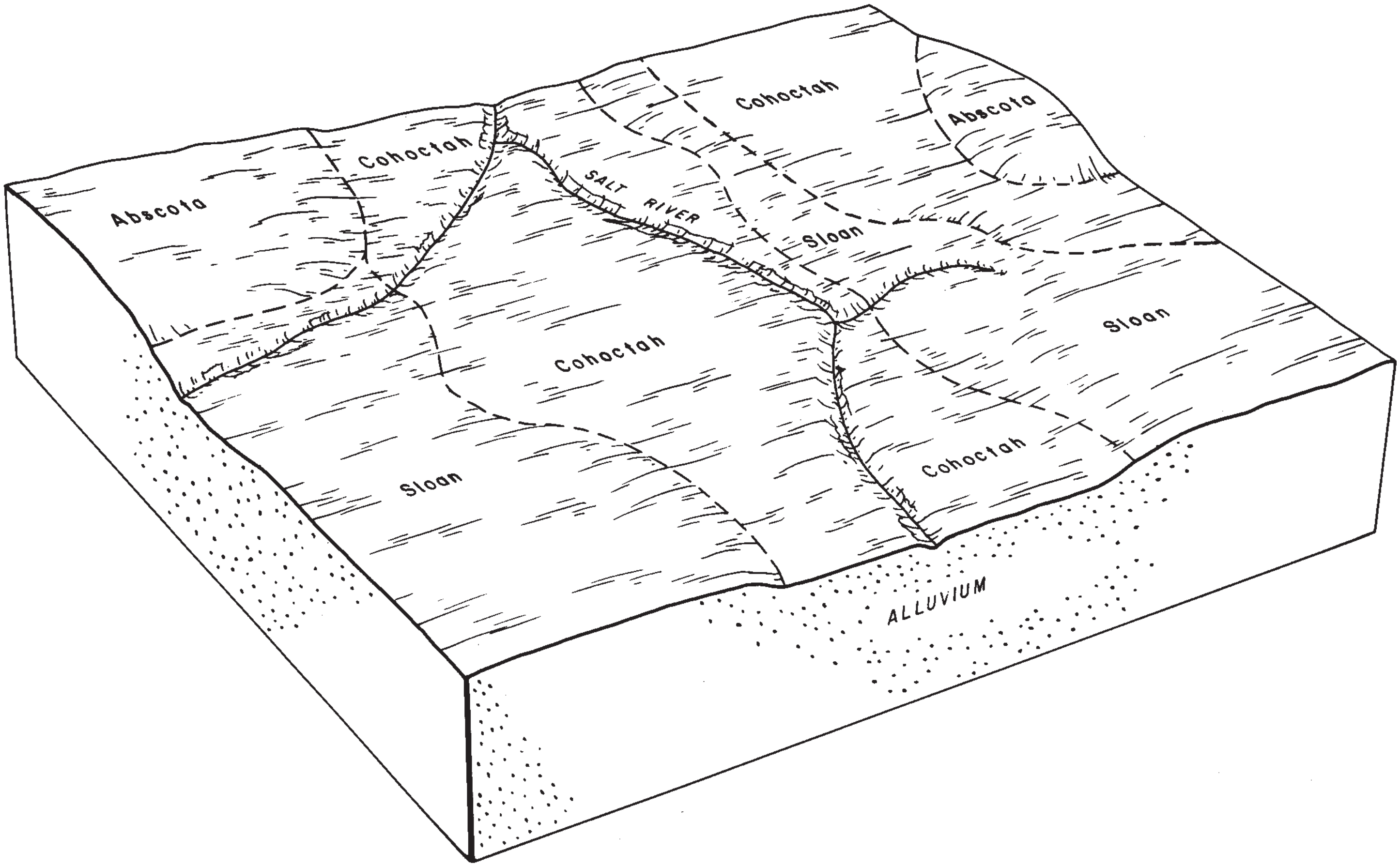

Abscota
Cohoctah
Cohoctah
Abscota
SALT RIVER
Sloan
Sloan
Cohoctah
Sloan
Cohoctah
ALLUVIUM

Figure 1.—Pattern of soils and underlying material in the Cohoctah-Sloan map unit.

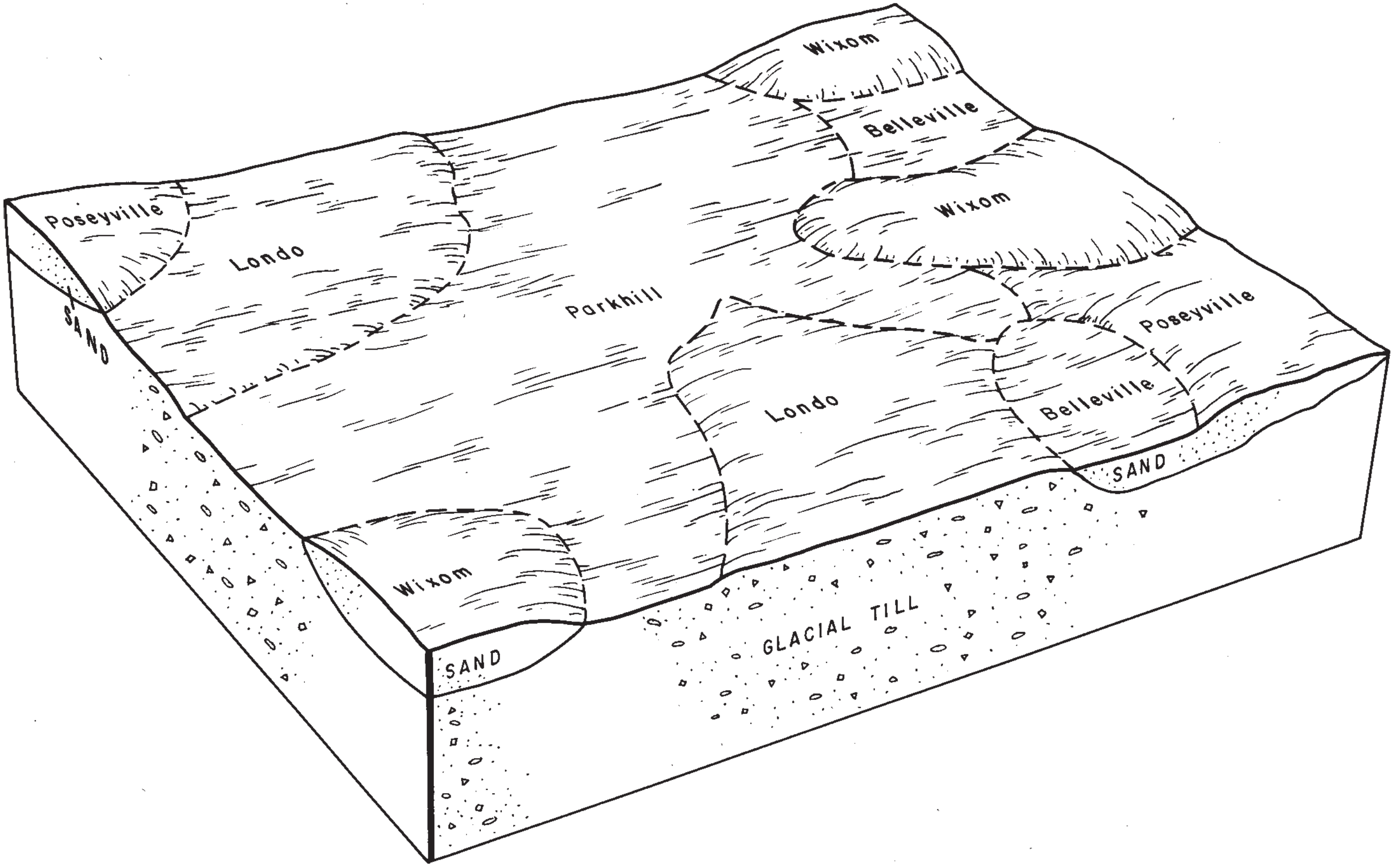

Wixom
Belleville
Poseyville
Londo
Wixom
Parkhill
Poseyville
Londo
Belleville
SAND
SAND
Wixom
SAND
GLACIAL TILL

Figure 2.—Pattern of soils and underlying material in the Parkhill-Londo map unit.

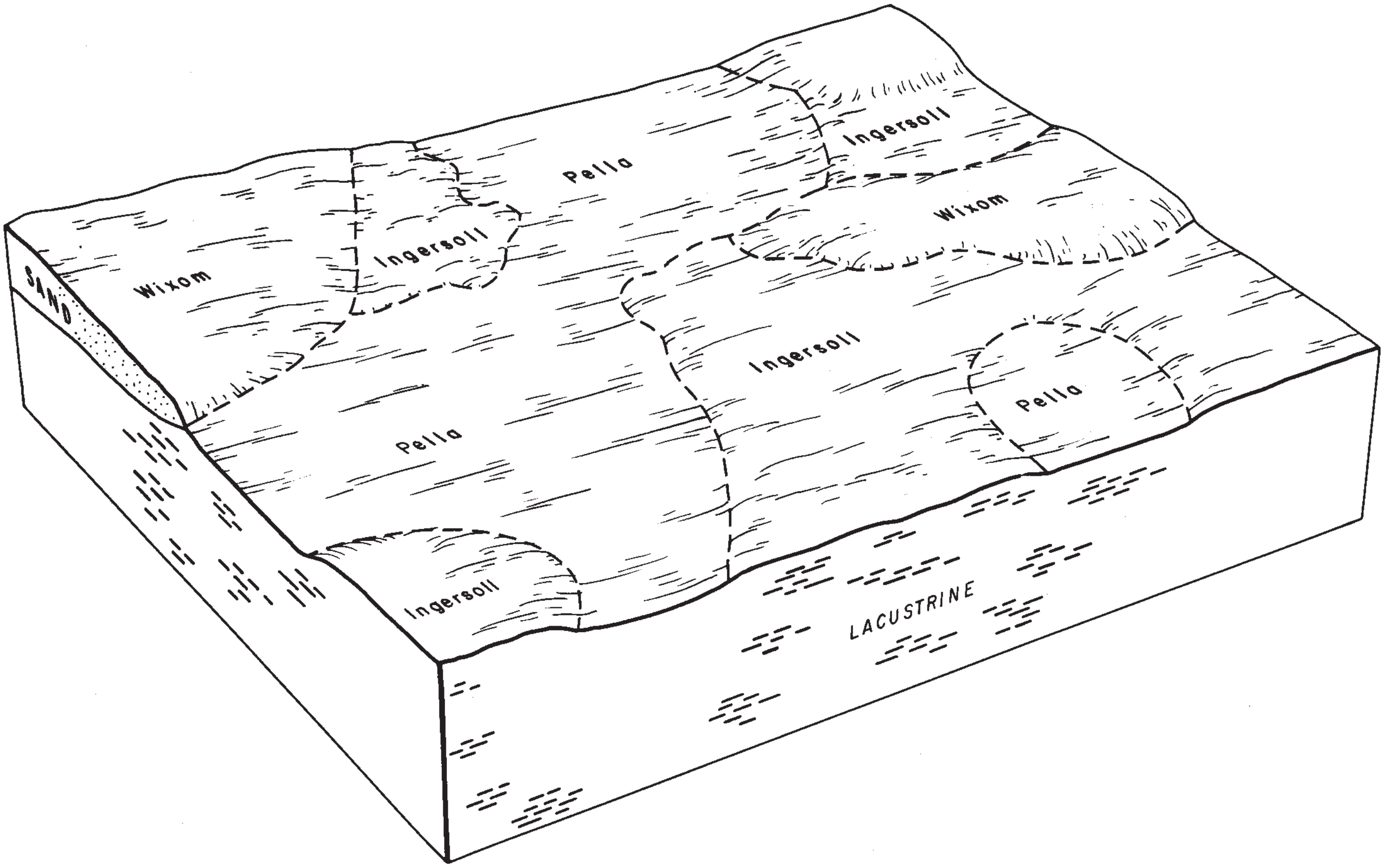

Ingersoll
Pella
Ingersoll
Wixom
Wixom
SAND
Ingersoll
Pella
Pella
Ingersoll
LACUSTRINE

Figure 3.—Pattern of soils and underlying material in the Ingersoll-Pella map unit.

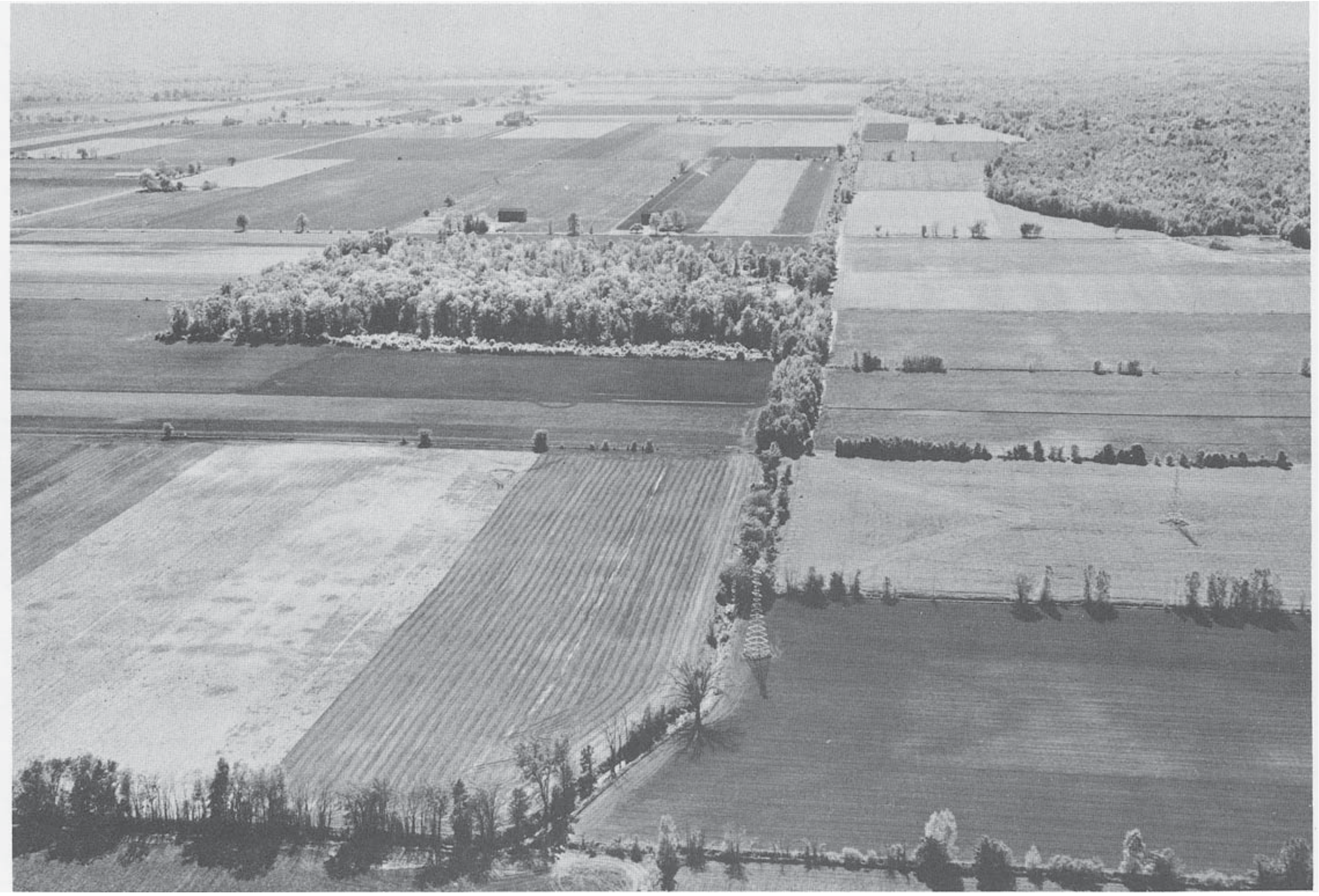


Figure 4.—An area of the Lenawee-Bowers-Wixom map unit. These drained areas are used extensively for crops. The dark areas are Lenawee soils, and the light areas are Wixom soils.

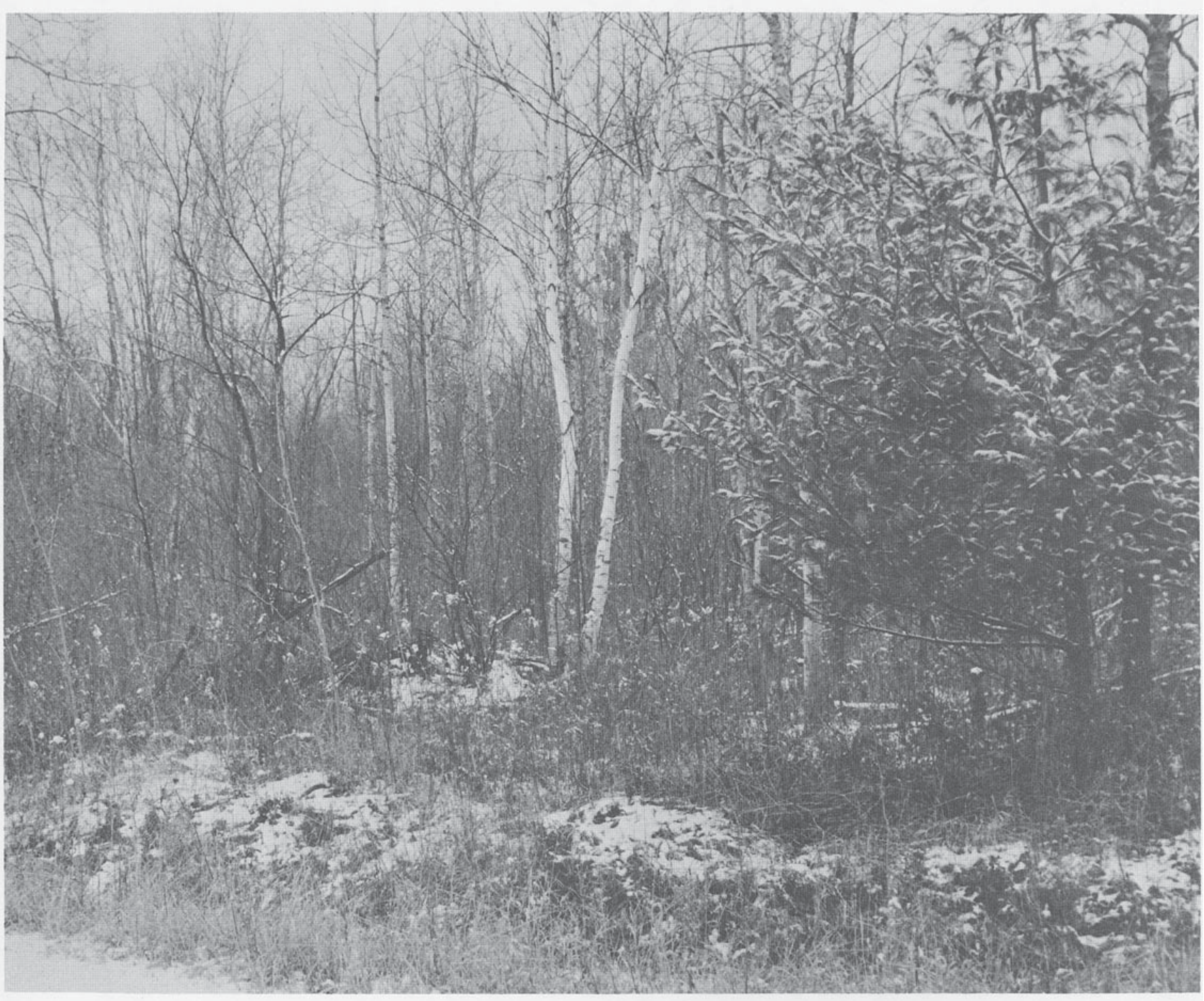


Figure 5.—Typical woodland of birch, aspen, hemlock, and maple in an area of the Wixom-Belleville-Pipestone map unit.

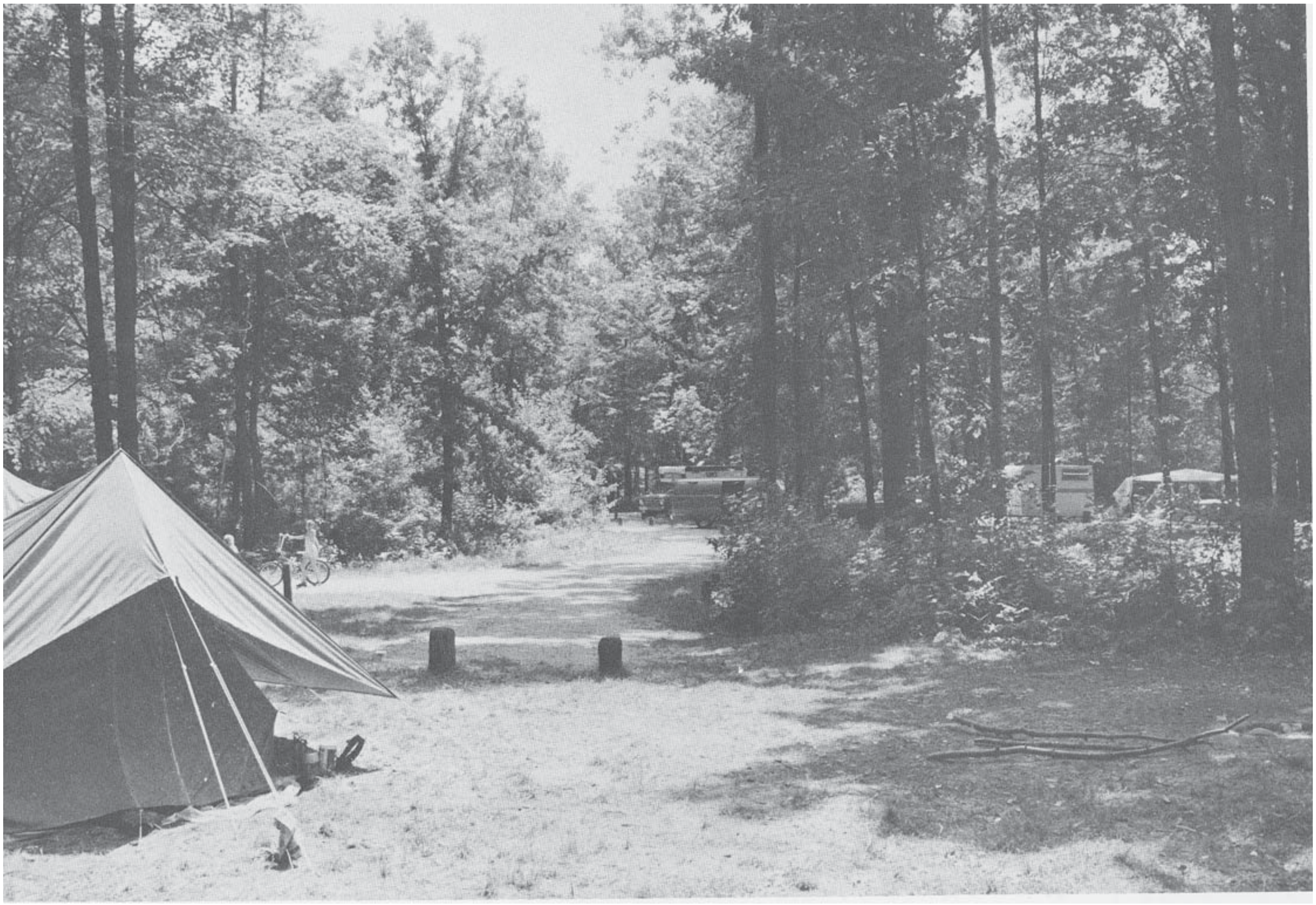


Figure 6.—A recreation area on the Kingsville-Pipestone-Covert map unit. The soil is too wet for community development.

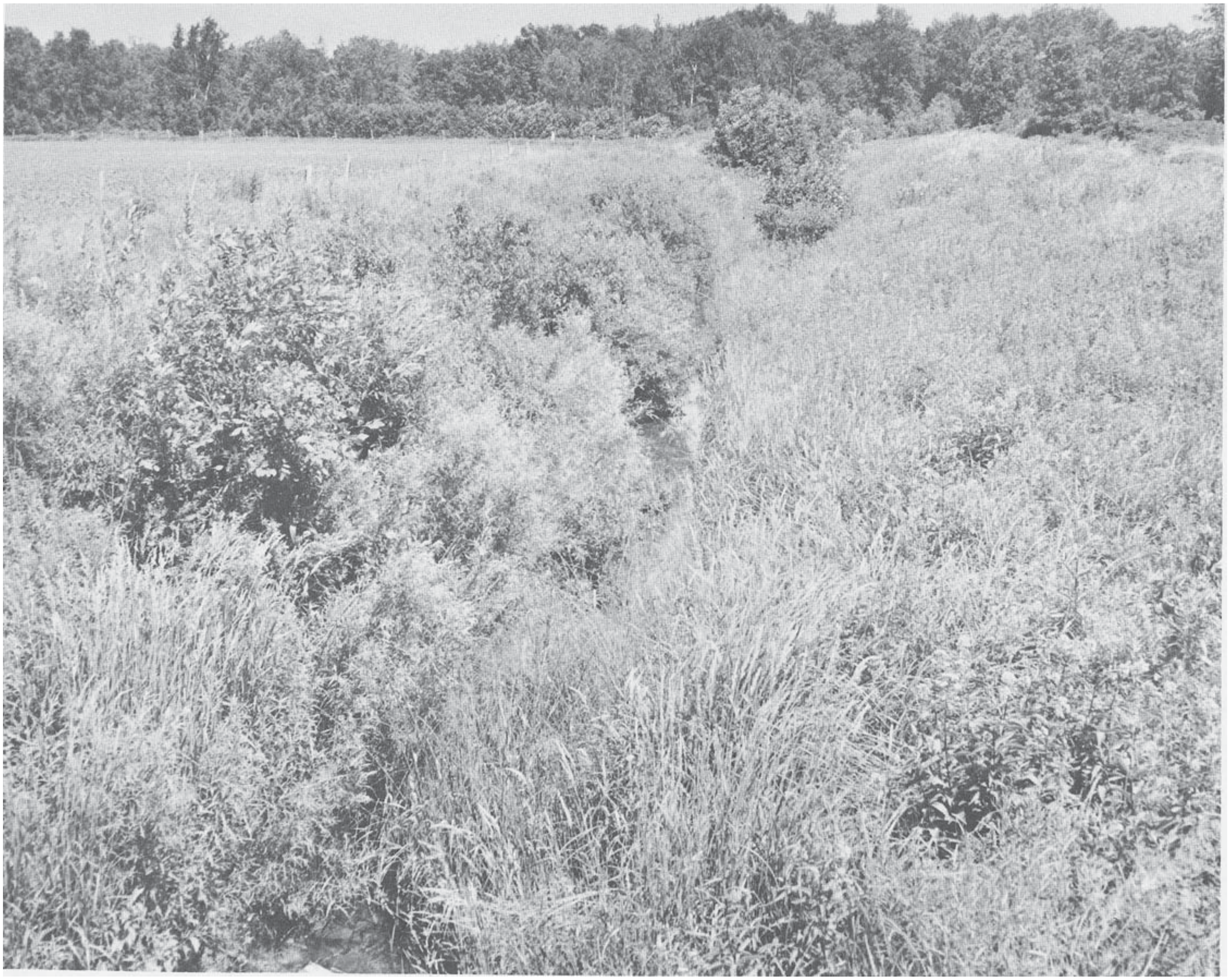


Figure 7.—Open drainage ditch in an area of Kingsville soils. Clogging of the drains by vegetation is a serious problem.

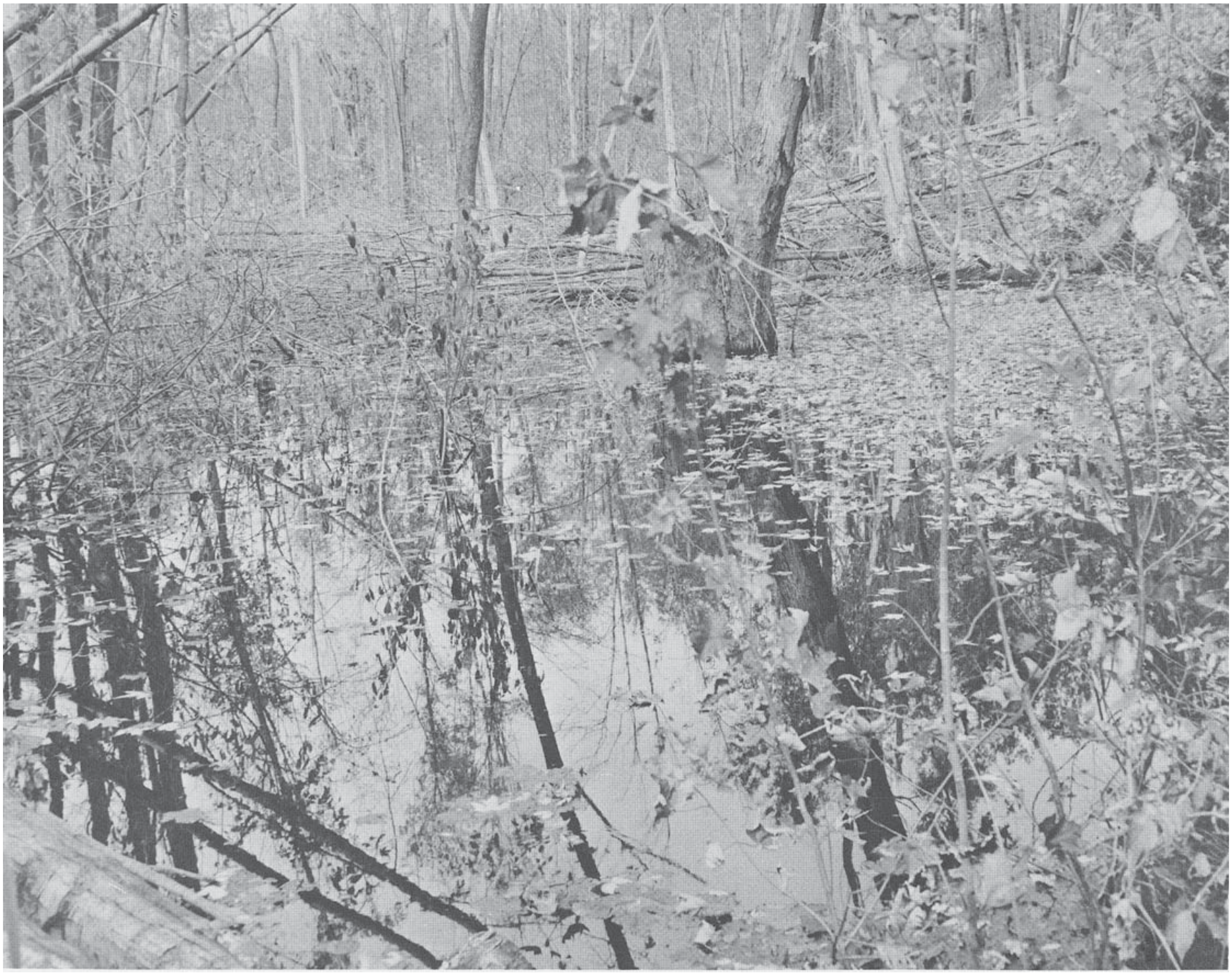


Figure 8.—Ponded area of Kingsville loamy fine sand. This poorly drained soil is poorly suited to community development.

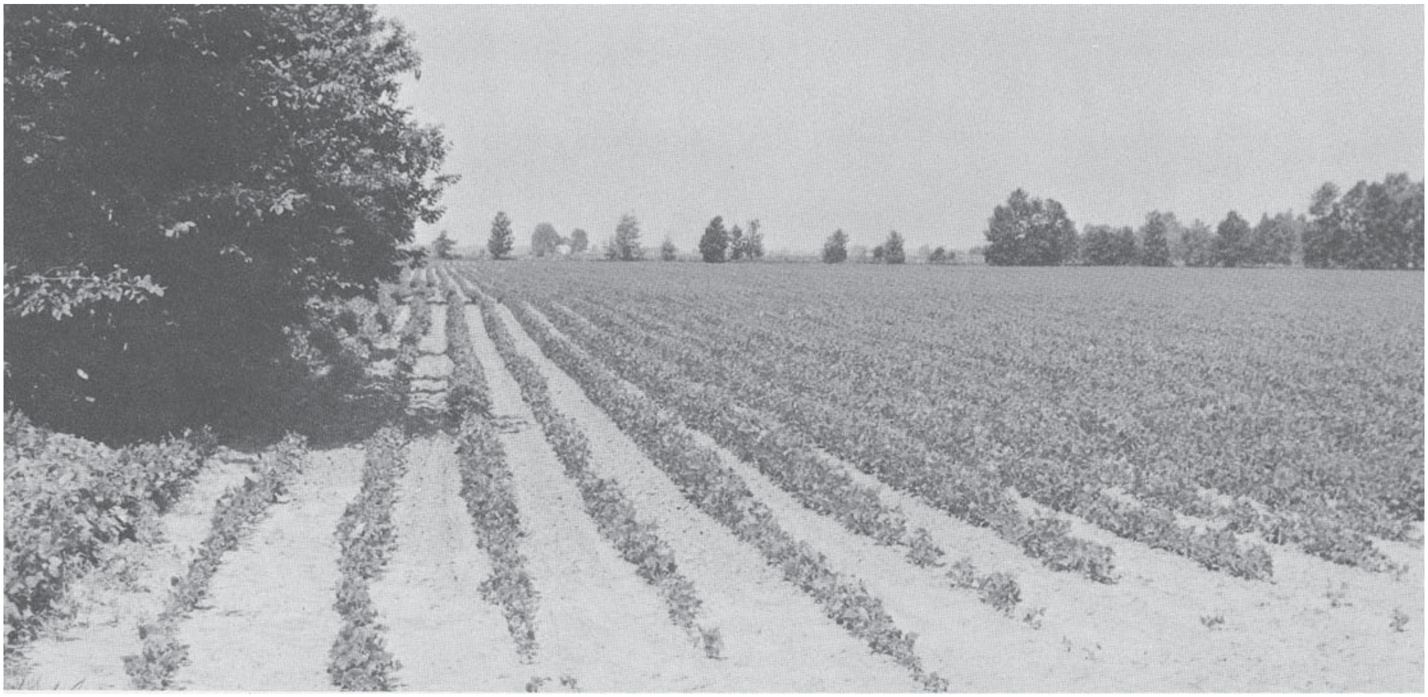


Figure 9.—Soybeans on Londo loam, 0 to 3 percent slopes. Tile and open ditches drain the area.

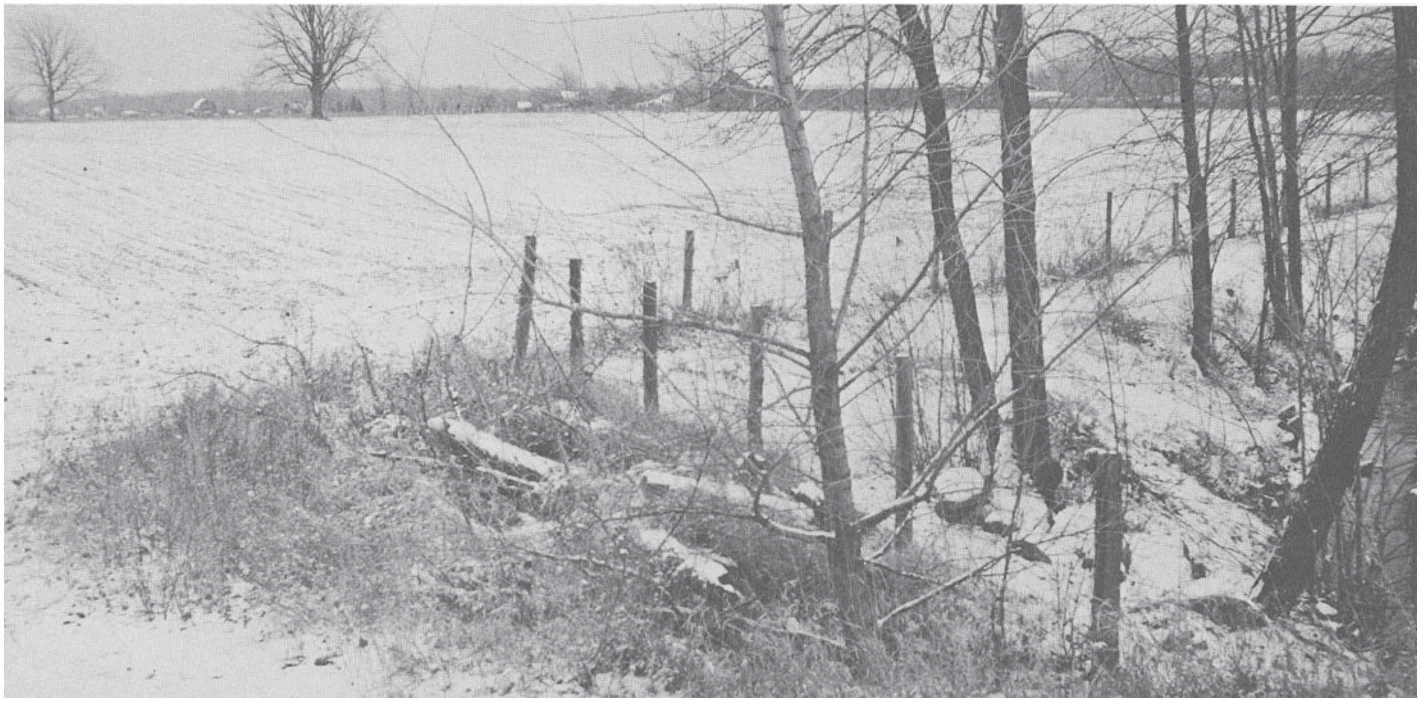


Figure 10.—Tile-drained area of Wixom loamy sand, 0 to 3 percent slopes. Most tile drains outlet into open ditches. This open ditch is overgrown with trees, a common problem.

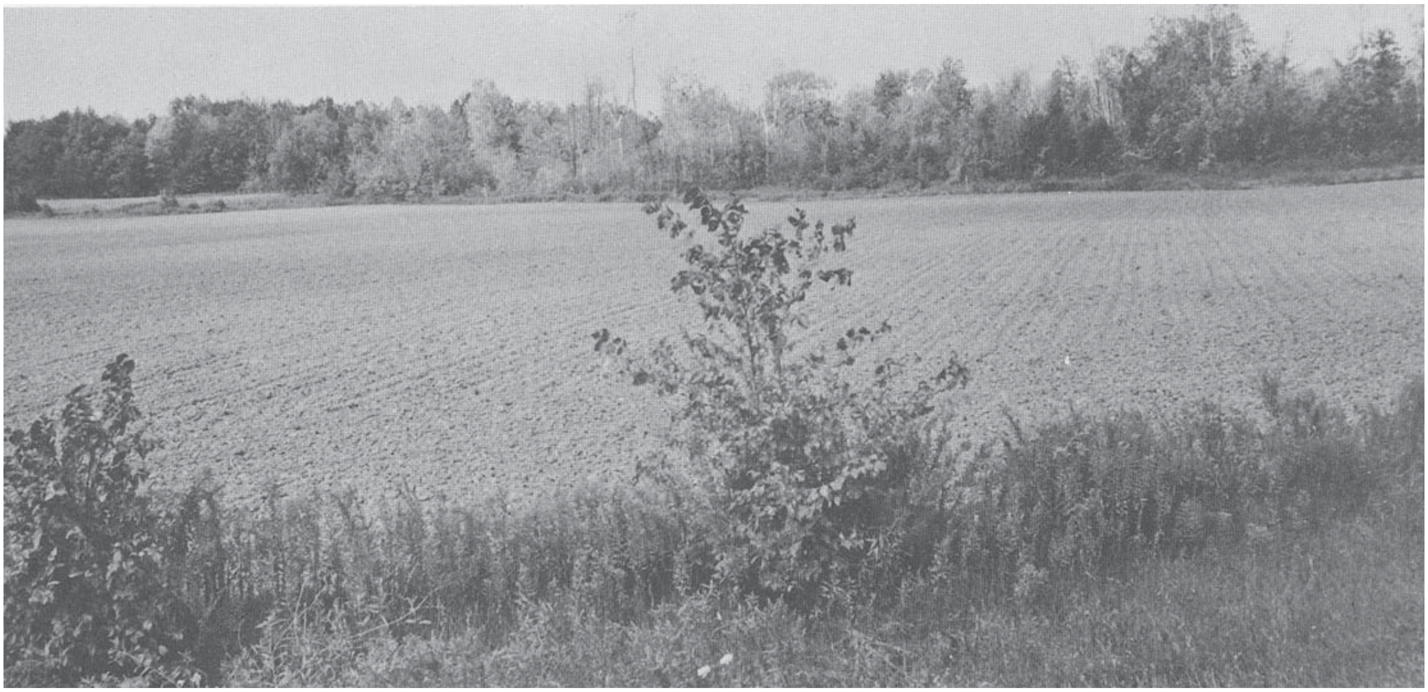


Figure 11.—Drained area of Lenawee-Wixom complex, 0 to 4 percent slopes. If drained, these soils are well suited to crops. The dark areas are Lenawee soils, and the light areas are Wixom soils.

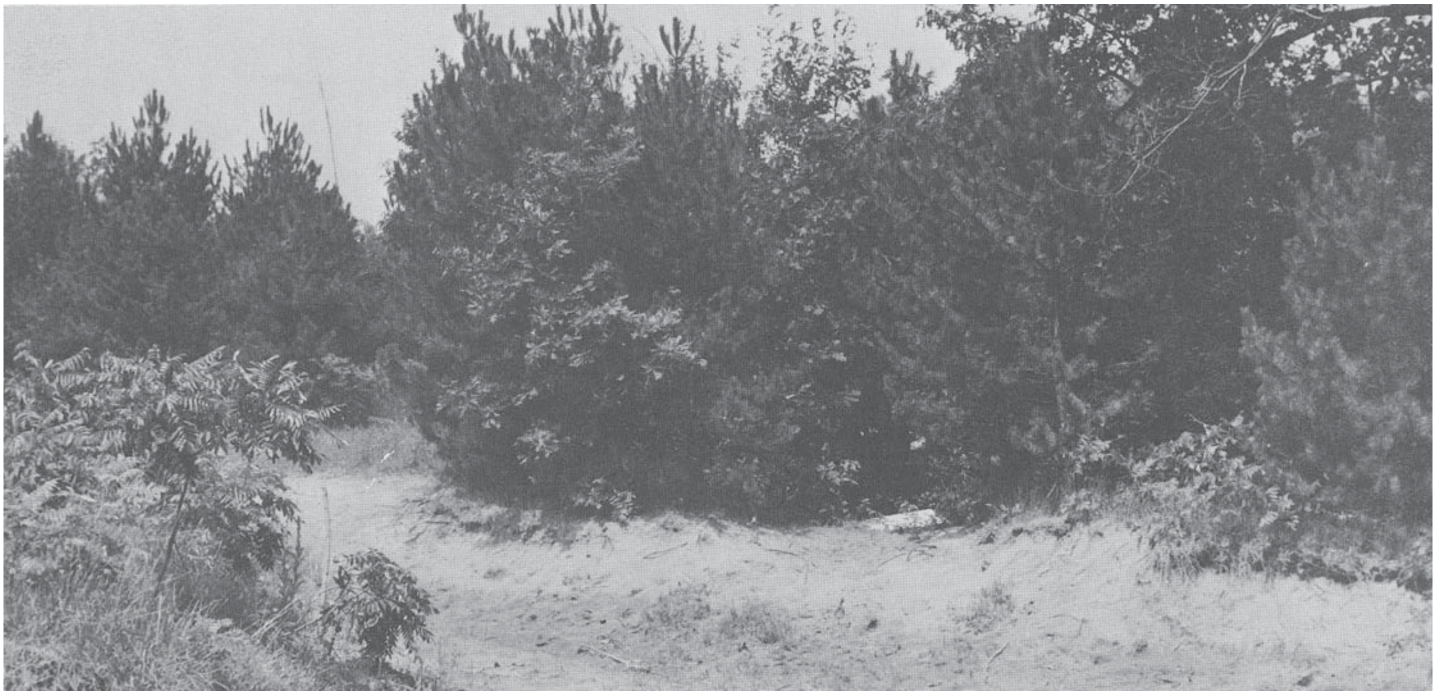


Figure 12.—A ridge of Oakville fine sand, 0 to 6 percent slopes. Pine, oak, and fern, the typical vegetation, are along a sand road. These ridges are commonly used as borrow areas and left idle.

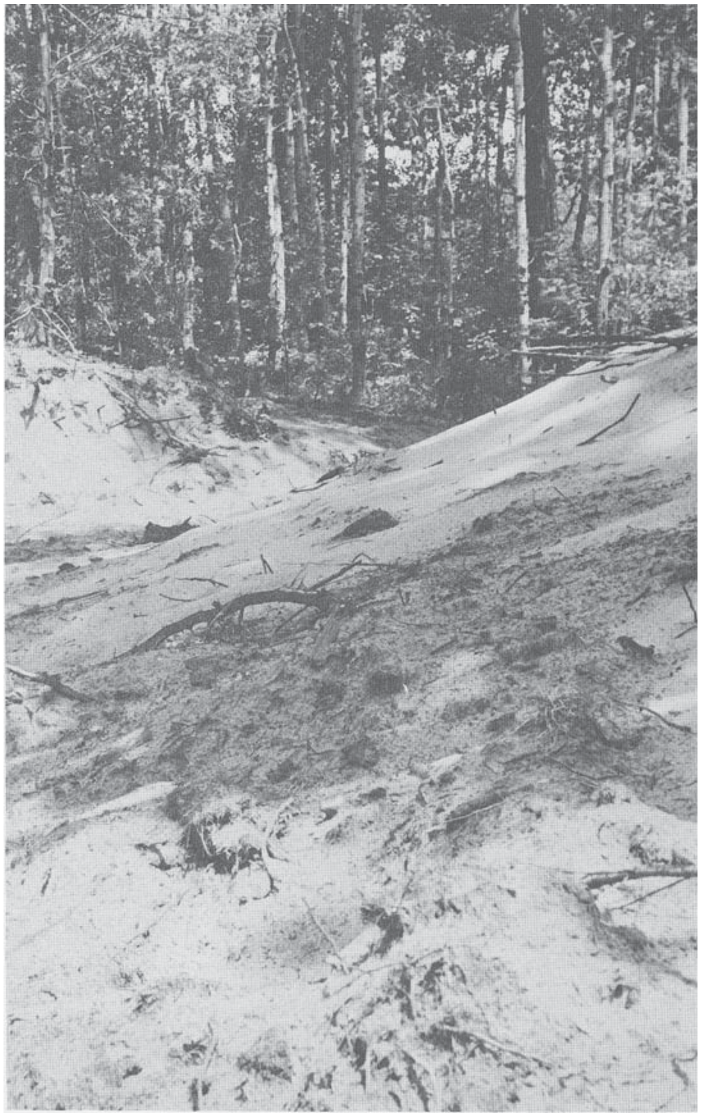


Figure 13.—Borrow area on a ridge of Covert sand, 0 to 6 percent slopes. Once the vegetation is removed, stabilizing and revegetating the sand is difficult and soil blowing is a hazard.

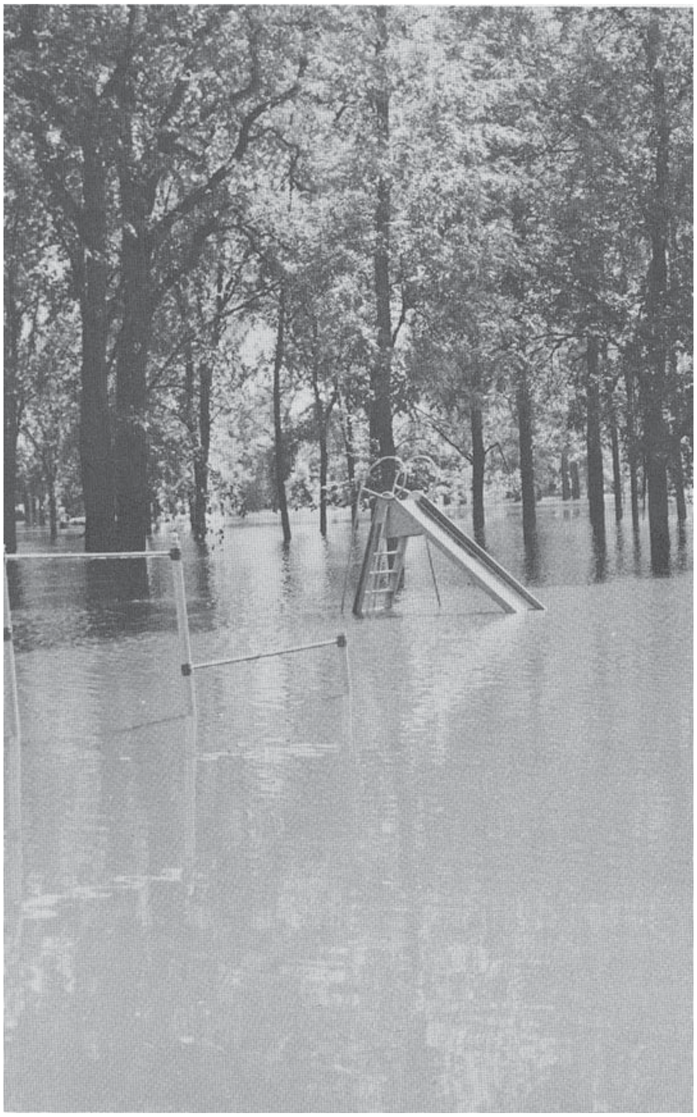


Figure 14.—An area of Cohoctah soils. Using the flood plain for a playground was a wise decision. Homes or businesses would have suffered heavy damages.

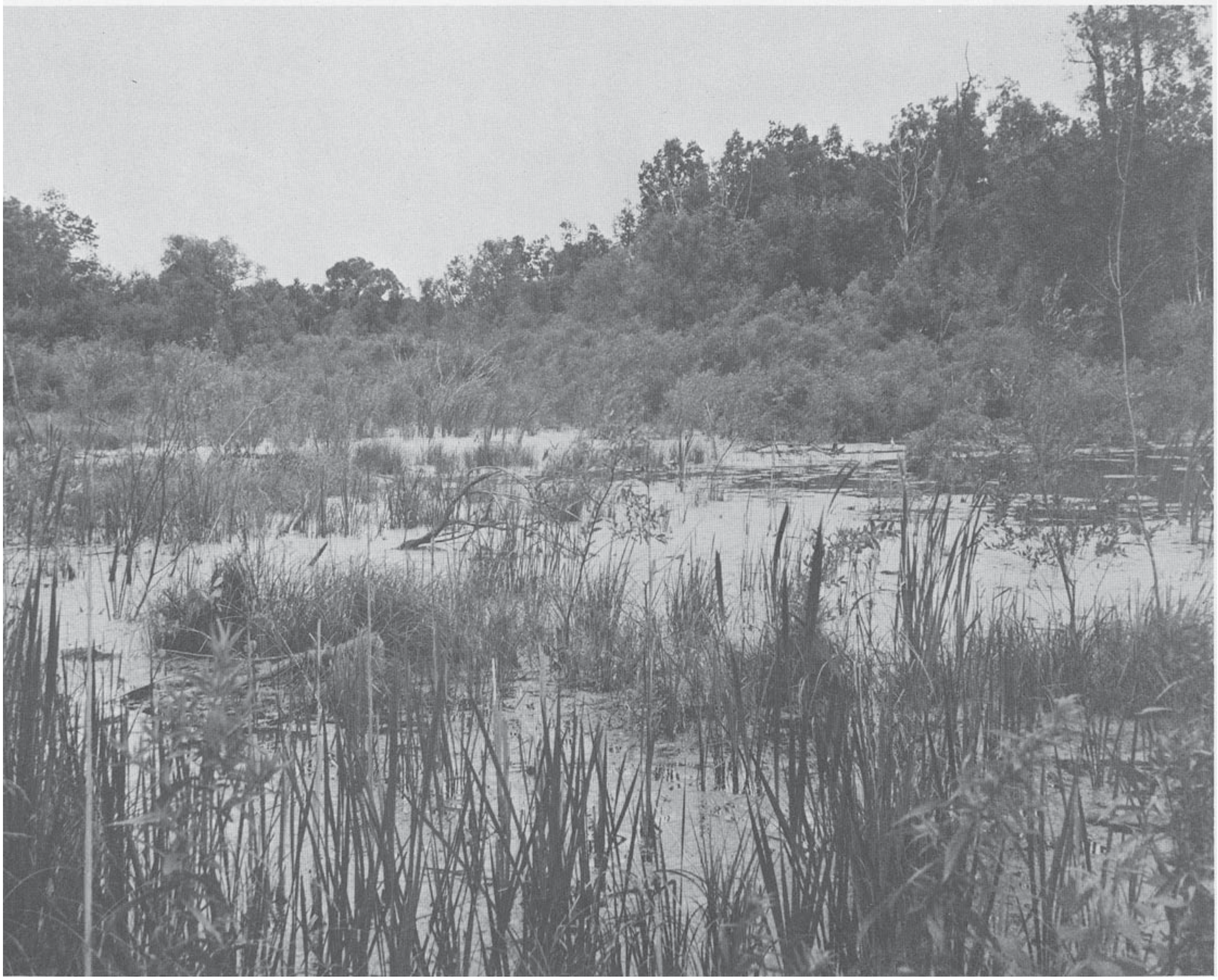


Figure 15.—An area of Adrian muck. This soil is well suited to ponds and wetland wildlife.

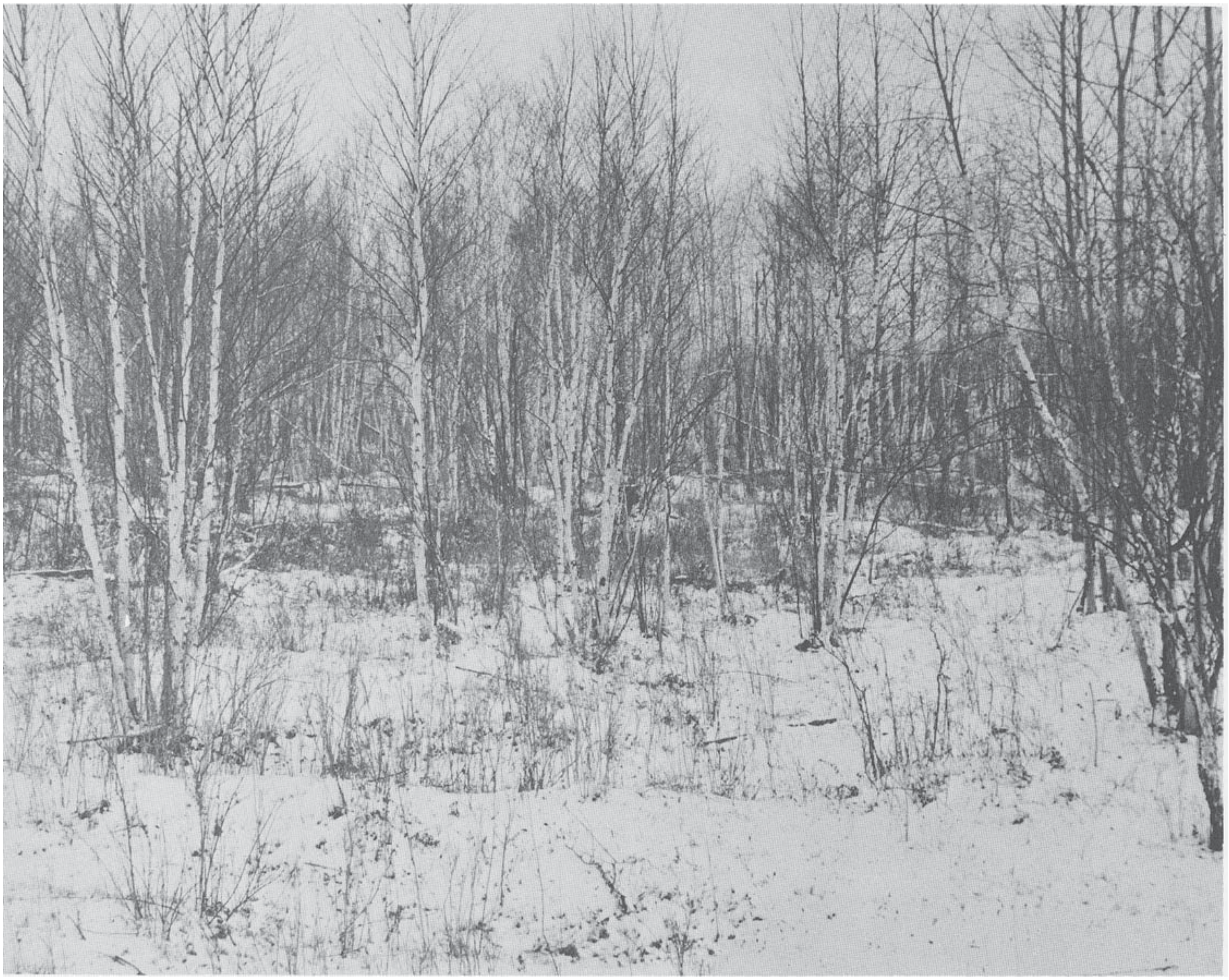


Figure 16.—An area of Pipestone sand. This soil has a high water table. Microrelief is small knolls and depressions.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days[2]	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	30.4	16.0	23.2	53	-11	0	1.64	0.9	2.3	5	9.5
February---	32.1	16.2	24.1	50	-10	0	1.51	0.7	2.2	4	8.7
March------	41.0	24.4	32.7	70	0	10	2.14	1.3	2.9	6	6.9
April------	56.5	36.0	46.2	81	17	73	2.83	1.8	3.7	7	1.5
May--------	68.5	45.9	57.2	88	28	259	2.64	1.5	3.7	6	T[3]
June-------	78.8	56.2	67.5	96	38	533	3.00	1.7	4.2	6	0
July-------	82.7	60.2	71.4	94	44	672	2.67	1.3	3.9	5	0
August-----	80.8	58.6	69.7	95	43	619	3.07	1.4	4.5	6	0
September--	72.8	51.3	62.1	92	31	376	2.82	1.7	3.8	6	T[3]
October----	62.9	42.4	52.6	84	23	162	2.47	1.0	3.7	5	0.3
November---	46.5	32.1	39.3	70	9	18	2.27	1.6	2.9	6	3.2
December---	34.4	21.4	27.9	60	-4	0	2.21	1.1	3.2	5	8.0
Year-----	57.3	38.4	47.8	97	-12	2,716	29.28	25.6	32.9	67	38.2

[1] Recorded in the period 1946-75 at Midland.

[2] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

[3] Trace.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1]		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 21	May 8	May 26
2 years in 10 later than--	April 17	May 3	May 19
5 years in 10 later than--	April 9	April 24	May 8
First freezing temperature in fall:			
1 year in 10 earlier than--	October 20	October 6	September 22
2 years in 10 earlier than--	October 25	October 13	September 26
5 years in 10 earlier than--	November 6	October 24	October 6

[1] Recorded in the period 1930-74 at Midland.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1]		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	187	160	128
8 years in 10	196	168	136
5 years in 10	211	182	150
2 years in 10	227	197	165
1 year in 10	234	204	172

[1] Recorded in the period 1930-74 at Midland.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AbB	Abscota loamy sand, 0 to 6 percent slopes	815	0.3
Ad	Adrian muck	2,340	0.7
AeB	Aquents	2,370	0.7
Be	Belleville loamy sand	29,625	8.9
BoB	Bowers silt loam, 0 to 3 percent slopes	7,790	2.3
Ch	Cohoctah fine sandy loam, gravelly substratum	7,130	2.1
CoB	Covert sand, 0 to 6 percent slopes	25,275	7.6
CsB	Covert sand, loamy substratum, 0 to 6 percent slopes	3,720	1.1
InB	Ingersoll silt loam, 0 to 3 percent slopes	6,645	2.0
Kg	Kingsville loamy fine sand	50,760	15.3
Kn	Kinross mucky sand	6,980	2.1
Le	Lenawee silty clay loam	17,860	5.4
LrB	Lenawee-Wixom complex, 0 to 4 percent slopes	1,660	0.5
LxA	Londo loam, 0 to 3 percent slopes	7,735	2.3
MeB	Menominee sand, 2 to 6 percent slopes	1,580	0.5
OaB	Oakville fine sand, 0 to 6 percent slopes	7,085	2.1
Pa	Parkhill loam	19,195	5.8
Pe	Pella silt loam	4,115	1.2
PsB	Pipestone sand, 0 to 3 percent slopes	49,290	14.8
PtB	Pipestone sand, loamy substratum, 0 to 3 percent slopes	17,420	5.2
PuB	Pipestone-Oakville-Urban land complex, 0 to 6 percent slopes	3,730	1.1
PwB	Plainfield sand, 0 to 6 percent slopes	3,315	1.0
PxB	Poseyville-Londo complex, 0 to 4 percent slopes	5,395	1.6
Sz	Sloan loam	2,950	0.9
Ur	Urban land	4,660	1.4
Wa	Wauseon sandy loam	1,755	0.5
WxB	Wixom loamy sand, 0 to 3 percent slopes	35,820	10.8
WzB	Wixom-Belleville-Urban land complex, 0 to 3 percent slopes	2,530	0.8
	Water	3,255	1.0
	Total	332,800	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS

[All yields were estimated for a high level of management in 1977. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Corn silage	Winter wheat	Oats	Soybeans	Grass-legume hay	Sugar beets
	Bu	Ton	Bu	Bu	Bu	Ton	Ton
AbB Abscota	70	13	28	60	---	3.0	---
Ad. Adrian							
AeB*. Aquents							
Be Belleville	80	13	38	60	33	2.7	17
BoB Bowers	95	18	50	90	40	4.0	20
Ch Cohoctah	---	---	---	---	---	3.0	---
CoB Covert	50	10	20	30	---	2.0	---
CsB Covert	65	11	30	55	---	2.8	---
InB Ingersoll	115	20	60	100	40	4.5	20
Kg Kingsville	75	12	30	70	30	3.0	---
Kn Kinross	---	---	---	---	---	---	---
Le Lenawee	105	17	48	75	38	3.0	20
LrB Lenawee	101	17	47	77	36	3.4	20
LxA Londo	115	18	60	100	45	5.0	20
MeB Menominee	85	15	42	70	30	3.5	---
OaB Oakville	60	12	30	55	20	2.5	---
Pa Parkhill	120	17	55	80	40	4.2	23
Pe Pella	116	18	55	90	40	4.5	23
PsB Pipestone	60	12	30	60	25	3.0	13
PtB Pipestone	80	14	35	65	25	3.5	14
PuB Pipestone	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn	Corn silage	Winter wheat	Oats	Soybeans	Grass-legume hay	Sugar beets
	Bu	Ton	Bu	Bu	Bu	Ton	Ton
PwB------------------------ Plainfield	40	6	20	25	---	1.5	---
PxB------------------------ Poseyville	103	17	52	92	38	4.3	19
Sz------------------------- Sloan	120	---	45	---	42	5.0	---
Ur*. Urban land							
Wa------------------------- Wauseon	100	16	40	70	30	4.0	18
WxB------------------------ Wixom	95	16	45	80	35	3.8	15
WzB------------------------ Wixom	---	---	---	---	---	---	---

* See map unit description for the composition and behavior of the map unit.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas excluded. Absence of an entry means no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	70,395	---	70,395	---	---
III	86,200	---	84,620	1,580	---
IV	136,945	---	100,050	36,895	---
V	12,420	---	12,420	---	---
VI	10,295	---	6,980	3,315	---
VII	---	---	---	---	---
VIII	---	---	---	---	---

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry means the information was not available]

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
AbB	Slight	Slight	Slight	Slight	Moderate	Northern red oak	66	Eastern cottonwood,
Abscota						White ash	61	eastern white pine,
						Silver maple	86	black walnut,
						Eastern cottonwood	96	American basswood,
						American basswood	61	red pine.
Ad	Slight	Severe	Severe	Severe	Severe	Red maple	51	
Adrian						Silver maple	78	
						White ash	51	
						Tamarack	45	
						Northern white-cedar	27	
Be	Slight	Severe	Moderate	Moderate	Severe	Quaking aspen	45	Black spruce.
Belleville						Red maple	40	
						Tamarack	35	
						Pin oak	40	
						Black ash	40	
BoB	Slight	Moderate	Slight	Slight	Moderate	Sugar maple	50	White spruce,
Bowers						American basswood	51	red pine,
						Paper birch	51	American basswood,
						Yellow birch	50	eastern white pine,
						Balsam fir	50	northern white-cedar,
						Northern red oak	51	Austrian pine,
						Quaking aspen	56	balsam fir.
Ch	Slight	Severe	Severe	Moderate	Severe	Red maple	66	Eastern cottonwood,
Cohoctah						Eastern cottonwood	96	American sycamore,
						Silver maple	86	white spruce,
						White ash	61	eastern white pine,
						Swamp white oak	61	American basswood,
						American sycamore	---	northern white-cedar.
CoB	Slight	Slight	Severe	Slight	Moderate	Red pine	58	Red pine,
Covert						Quaking aspen	66	eastern cottonwood,
						Black cherry	---	eastern white pine,
						Northern red oak	96	black walnut.
						Paper birch	61	
CsB	Slight	Slight	Severe	Slight	Moderate	Northern red oak	61	Red pine,
Covert						Quaking aspen	66	eastern white pine,
						Eastern cottonwood	61	black walnut,
						American basswood	61	eastern cottonwood.
InB	Slight	Moderate	Slight	Slight	Moderate	Northern red oak	61	White spruce,
Ingersoll						White oak	61	Austrian pine,
						Red maple	61	eastern cottonwood,
						American basswood	61	Norway spruce,
						Butternut	---	red maple,
						Shagbark hickory	---	silver maple,
						Bur oak	61	black walnut,
						White ash	61	black cherry.
Kg	Slight	Severe	Severe	Severe	---------	Pin oak	51	Norway spruce,
Kingsville						Northern red oak	51	eastern white pine.
						American sycamore	---	
Kn	Slight	Severe	Severe	Moderate	Severe	Quaking aspen	45	Black spruce.
Kinross						Black spruce	15	
						Tamarack	35	
						Northern white-cedar	15	
						Balsam fir	---	
						Sugar maple	40	
						Red maple	40	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
Le Lenawee	Slight	Severe	Severe	Moderate	Severe	Red maple	51	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						White ash	51	
						American basswood	51	
						Silver maple	78	
LrB*:								
Lenawee	Slight	Severe	Severe	Moderate	Severe	Red maple	51	White spruce, Norway spruce, eastern white pine, northern white-cedar.
						White ash	51	
						American basswood	51	
						Silver maple	78	
Wixom	Slight	Moderate	Severe	Slight	Slight	Quaking aspen	56	Eastern white pine, Norway spruce, black cherry, Austrian pine, red maple, silver maple, Austrian pine, northern white-cedar.
						American beech	---	
						White oak	51	
						Red maple	51	
						Sugar maple	50	
						Black cherry	---	
						American basswood	51	
LxA Londo	Slight	Moderate	Slight	Slight	Moderate	Sugar maple	58	White spruce, eastern cottonwood, Norway spruce, American basswood, eastern white pine, northern white-cedar, black walnut, northern red oak, pin oak.
						Northern red oak	61	
						Black oak	61	
						Eastern white pine	58	
						American basswood	61	
						Yellow birch	58	
						Paper birch	61	
						Eastern cottonwood	96	
						White ash	61	
MeB Menominee	Slight	Slight	Severe	Slight	Moderate	Sugar maple	58	Red pine, white spruce, eastern white pine, Austrian pine, American basswood, paper birch, black cherry, balsam fir.
						Quaking aspen	66	
						Red pine	58	
						Silver maple	86	
						Paper birch	61	
						Yellow birch	58	
						American basswood	61	
						Black cherry	---	
OaB Oakville	Slight	Slight	Severe	Slight	Moderate	Northern red oak	66	Red pine, eastern white pine, jack pine, black walnut, black cherry.
						White oak	61	
						Red pine	58	
						Quaking aspen	66	
						Black oak	61	
Pa Parkhill	Slight	Severe	Moderate	Moderate	Severe	Red maple	66	White spruce, eastern white pine, green ash, eastern cottonwood, American basswood, northern white-cedar.
						Silver maple	96	
						Pin oak	61	
						White ash	61	
						American basswood	61	
						Quaking aspen	66	
Pe Pella	Slight	Severe	Moderate	Moderate	Severe	Red maple	51	Northern white-cedar, white spruce, tamarack, black spruce, pin oak, green ash.
						Northern red oak	51	
						White ash	51	
						Silver maple	78	
						American basswood	50	
						Quaking aspen	56	
PsB Pipestone	Slight	Moderate	Severe	Slight	Slight	Quaking aspen	56	White spruce, eastern cottonwood, eastern white pine, Norway spruce.
						Bigtooth aspen	56	
						Eastern cottonwood	86	
						Northern red oak	51	
						Shagbark hickory	---	
						White ash	51	
						Sugar maple	50	
						Swamp white oak	51	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
PtB Pipestone	Slight	Moderate	Moderate	Slight	Slight	Northern red oak	61	White spruce,
						White ash	61	eastern cottonwood,
						Shagbark hickory	---	eastern white pine,
						Red maple	61	Norway spruce,
						American basswood	61	white ash,
						Black ash	---	red maple,
						Pin oak	61	American basswood.
						Eastern cottonwood	96	
PuB*:								
Pipestone	Slight	Moderate	Severe	Slight	Slight	Quaking aspen	56	White spruce,
						Bigtooth aspen	56	eastern cottonwood,
						Eastern cottonwood	86	eastern white pine,
						Northern red oak	51	Norway spruce,
						Shagbark hickory	---	black spruce,
						White ash	51	Austrian pine,
						Sugar maple	50	northern red oak,
						Swamp white oak	51	white ash.
Oakville	Slight	Slight	Severe	Slight	Moderate	Northern red oak	66	Red pine,
						White oak	61	eastern white pine,
						Red pine	58	jack pine,
						Quaking aspen	66	Norway spruce,
						Black oak	---	black walnut,
						Sugar maple	58	black cherry.
						Black cherry	---	
						White ash	61	
Urban land.								
PwB Plainfield	Slight	Slight	Severe	Slight	Moderate	Red pine	58	Red pine,
						Eastern white pine	68	eastern white pine,
						Jack pine	61	jack pine,
						Northern pin oak	61	Norway spruce,
						Black oak	61	black walnut,
								black cherry.
PxB*:								
Poseyville	Slight	Moderate	Moderate	Slight	Moderate	Sugar maple	62	White spruce,
						Northern red oak	61	Austrian pine,
						American basswood	61	eastern cottonwood.
						Eastern cottonwood	96	
						Paper birch	61	
Londo	Slight	Moderate	Slight	Slight	Moderate	Sugar maple	61	White spruce,
						Northern red oak	61	eastern cottonwood,
						Black oak	61	Norway spruce,
						Eastern white pine	58	American basswood,
						American basswood	61	eastern white pine,
						Yellow birch	58	northern white-cedar,
						Paper birch	61	balsam fir,
						Eastern cottonwood	96	black walnut,
						White ash	61	northern red oak.
Sz Sloan	Slight	Severe	Severe	Severe	Severe	Red maple	61	White spruce,
						Swamp white oak	61	northern white-cedar,
						Silver maple	86	red maple.
Wa Wauseon	Slight	Severe	Severe	Severe	Severe	Red maple	61	White spruce,
						Silver maple	86	silver maple,
						White ash	61	white ash.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Management concerns					Potential productivity		Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	
WxB---------------- Wixom	Slight	Moderate	Severe	Slight	Slight	Quaking aspen--------	66	Eastern white pine,
						American beech------	---	Norway spruce,
						White oak-----------	61	black cherry,
						Red maple-----------	61	Austrian pine,
						Sugar maple---------	58	red maple,
						Black cherry--------	---	silver maple,
						American basswood---	61	Austrian pine,
								northern white-cedar.
WzB*:								
Wixom-------------	Slight	Moderate	Severe	Slight	Slight	Quaking aspen--------	66	Eastern white pine,
						American beech------	---	Norway spruce,
						White oak-----------	61	black cherry,
						Red maple-----------	61	Austrian pine.
						Sugar maple---------	58	
						Black cherry--------	---	
						American basswood---	61	
Belleville---------	Slight	Severe	Moderate	Moderate	Severe	Quaking aspen--------	44	Black spruce.
						Red maple-----------	40	
						Tamarack------------	35	
						Pin oak-------------	40	
						Black ash-----------	40	
Urban land.								

* See map unit description for the composition and behavior of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; the symbol > means greater than. Absence of an entry means that trees of the height class do not normally grow on this soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
AbB Abscota	Tatarian honeysuckle, white spruce, autumn-olive, Amur privet, lilac.	Black spruce, northern white-cedar, American mountainash.	Eastern white pine, red pine, Scotch pine, green ash, jack pine.	Carolina poplar.
Ad Adrian	Silky dogwood, American cranberrybush, white spruce.	Austrian pine, eastern white pine, tamarack.	Northern white-cedar, Scotch pine, Norway spruce, green ash.	Carolina poplar.
AeB*. Aquents				
Be Belleville	Silky dogwood, hawthorn, white spruce, Amur privet, arrowwood.	Black spruce, northern white-cedar, eastern white pine, Norway spruce, tamarack.	---	Carolina poplar.
BoB Bowers	White spruce, silky dogwood, blue spruce, Amur privet.	Northern white-cedar, black spruce, European larch, eastern white pine.	Red pine, Norway spruce.	Carolina poplar, white ash, green ash.
Ch Cohoctah	Silky dogwood, hawthorn, white spruce, arrowwood.	Northern white-cedar, black spruce, eastern white pine, Norway spruce.	---	Carolina poplar.
CoB, CsB Covert	White spruce, autumn-olive, Amur privet.	American mountainash, Siberian crabapple.	Scotch pine, eastern white pine.	---
InB Ingersoll	American cranberrybush, Tatarian honeysuckle, blue spruce.	Austrian pine, northern white-cedar, black spruce, European larch.	Norway spruce	White ash, Carolina poplar, green ash.
Kg Kingsville	Silky dogwood, white spruce, blue spruce, American cranberrybush.	Northern white-cedar, black spruce, European larch, tamarack, eastern white pine.	Norway spruce, red pine.	Carolina poplar, green ash, white ash.
Kn Kinross	Silky dogwood, hawthorn, white spruce, European larch, Douglas-fir.	Black spruce, red maple, tamarack, northern white-cedar, Norway spruce.	---	Carolina poplar.
Le Lenawee	Silky dogwood, hawthorn, white spruce, Amur privet, arrowwood, balsam fir.	Eastern white pine, black spruce, tamarack, northern white-cedar, Norway spruce.	---	Carolina poplar.
LrB*: Lenawee	Silky dogwood, hawthorn, Douglas-fir, European larch.	Eastern white pine, Norway spruce, northern white-cedar.	---	Carolina poplar.
Wixom	Silky dogwood, hawthorn, white spruce, arrowwood, whitebelle honeysuckle.	Eastern white pine, Austrian pine, northern white-cedar.	Norway spruce, red pine.	Green ash, Carolina poplar, white ash.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
LxA Londo	White spruce, Amur privet, American cranberrybush, blue spruce, silky dogwood.	Northern white-cedar, black spruce, Austrian pine, European larch, tamarack, eastern white pine.	Norway spruce, red pine.	Carolina poplar, green ash, white ash.
MeB Menominee	Arrowwood, lilac, white spruce, blue spruce, staghorn sumac.	Red pine, jack pine, Scotch pine, northern pin oak.	---	Red maple, Carolina poplar.
OaB Oakville	Tatarian honeysuckle, autumn-olive, lilac.	Black spruce, northern white-cedar, American mountainash.	Eastern white pine, jack pine, Scotch pine.	Carolina poplar, yellow-poplar.
Pa Parkhill	Amur privet, arrowwood, hawthorn, Siberian crabapple, silky dogwood, white spruce.	Northern white-cedar, eastern white pine, Norway spruce, tamarack.	---	Carolina poplar.
Pe Pella	Silky dogwood, Amur privet, hawthorn, white spruce.	Northern white-cedar, Norway spruce, eastern white pine, tamarack.	---	Carolina poplar.
PsB Pipestone	Blue spruce, American cranberrybush, late lilac, silky dogwood, white spruce.	Austrian pine, eastern white pine, European larch, northern white-cedar.	Norway spruce, red pine.	Green ash, Carolina poplar, white ash.
PtB Pipestone	White spruce, American cranberrybush, blue spruce, silky dogwood.	Austrian pine, northern white-cedar, eastern white pine.	Norway spruce, red pine.	Green ash, Carolina poplar, white ash.
PuB*:				
Pipestone	Blue spruce, American cranberrybush, late lilac, white spruce, silky dogwood.	Austrian pine, eastern white pine, northern white-cedar.	Norway spruce, red pine.	Green ash, Carolina poplar, white ash.
Oakville	Tatarian honeysuckle, autumn-olive, lilac.	Black spruce, American mountainash, northern white-cedar.	Eastern white pine, jack pine, Scotch pine.	Carolina poplar, yellow-poplar.
Urban land.				
PwB Plainfield	Lilac, Tatarian honeysuckle, autumn-olive.	Norway spruce, Siberian crabapple.	Eastern white pine, red pine, jack pine, Scotch pine.	Carolina poplar.
PxB*:				
Poseyville	American cranberrybush, blue spruce, Tatarian honeysuckle.	Austrian pine, northern white-cedar, eastern white pine, European larch.	Norway spruce, red pine.	White ash, Carolina poplar, green ash.
Londo	White spruce, Amur privet, American cranberrybush, blue spruce, silky dogwood.	Northern white-cedar, black spruce, Austrian pine, European larch, tamarack, Siberian crabapple, eastern white pine.	Norway spruce, red pine.	Carolina poplar, green ash, white ash.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	8-15	16-25	26-35	>35
Sz---------------- Sloan	Amur privet, hawthorn, silky dogwood, white spruce, arrowwood.	Northern white-cedar, eastern white pine, Norway spruce, tamarack.	---	Carolina poplar.
Ur*. Urban land				
Wa---------------- Wauseon	Silky dogwood, hawthorn, Douglas-fir, European larch.	Eastern white pine, Norway spruce, tamarack.	---	Carolina poplar.
WxB--------------- Wixom	Silky dogwood, white spruce, arrowwood, Amur privet, hawthorn.	Eastern white pine, Austrian pine, northern white-cedar, Norway spruce, tamarack.	Norway spruce, red pine.	Carolina poplar, green ash, white ash.
WzB*:				
Wixom------------	Silky dogwood, white spruce, blue spruce, American cranberrybush.	Eastern white pine, Austrian pine, northern white-cedar.	Norway spruce, red pine.	Green ash, Carolina poplar, white ash.
Belleville-------	Silky dogwood, hawthorn, white spruce, Amur privet, arrowwood.	Black spruce, northern white-cedar, eastern white pine, Norway spruce, tamarack.	---	Carolina poplar.
Urban land.				

* See map unit description for the composition and behavior of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basaments	Small commercial buildings	Local roads and streets
AbB---------------- Abscota	Severe: floods, wetness, cutbanks cave.	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Ad----------------- Adrian	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.
AeB*. Aquents					
Be----------------- Belleville	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Seveve: wetness, floods.	Severe: wetness, frost action, floods.
BoB---------------- Bowers	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.
Ch----------------- Cohoctah	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, frost action, wetness.
CoB---------------- Covert	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CsB---------------- Covert	Severe: cutbanks cave, wetness, too clayey.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Moderate: wetness.
InB---------------- Ingersoll	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness.
Kg----------------- Kingsville	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Kn----------------- Kinross	Severe: wetness, floods, cutbanks cave.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Le----------------- Lenawee	Severe: wetness, floods.	Severe: low strength, wetness, floods.	Severe: low strength, wetness, floods.	Severe: low strength, wetness, floods.	Severe: low strength, wetness, floods.
LrB*: Lenawee-----------	Severe: wetness, floods.	Severe: low strength, wetness, floods.	Severe: low strength, wetness, floods.	Severe: low strength, wetness, floods.	Severe: low strength, wetness, floods.
Wixom-------------	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
LxA----- Londo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.
MeB----- Menominee	Moderate: wetness.	Slight-----	Moderate: wetness.	Moderate: slope.	Slight.
OaB----- Oakville	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Slight-----	Slight.
Pa----- Parkhill	Severe: wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: low strength, floods, wetness.
Pe----- Pella	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.
PsB----- Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
PtB----- Pipestone	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
PuB*:					
Pipestone-----	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Oakville-----	Severe: cutbanks cave.	Slight-----	Moderate: wetness.	Slight-----	Slight.
Urban land.					
PwB----- Plainfield	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Slight.
PxB*:					
Poseyville-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness, low strength.
Londo-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.
Sz----- Sloan	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods, frost action.
Ur*. Urban land					
Wa----- Wauseon	Severe: wetness, cutbanks cave.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, frost action.
WxB----- Wixom	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
WzB*:					
Wixom------------	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.
Belleville-------	Severe: wetness, cutbanks cave, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, floods.
Urban land.					

* See map unit description for the composition and behavior of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AbB----------------- Abscota	Severe: floods, wetness.	Severe: floods, seepage.	Severe: floods, seepage, too sandy.	Severe: floods, seepage, wetness.	Poor: too sandy, seepage.
Ad------------------ Adrian	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: hard to pack, wetness.
AeB*. Aquents					
Be------------------ Belleville	Severe: wetness, percs slowly, floods.	Severe: wetness, seepage.	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Poor: wetness.
BoB----------------- Bowers	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
Ch------------------ Cohoctah	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness.
CoB----------------- Covert	Severe: wetness.	Severe: seepage, wetness.	Severe: too sandy, wetness, seepage.	Severe: seepage, wetness.	Poor: too sandy, seepage.
CsB----------------- Covert	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, too sandy.	Severe: wetness, seepage.	Poor: too sandy.
InB----------------- Ingersoll	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: thin layer.
Kg------------------ Kingsville	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage, floods.	Poor: wetness, too sandy, seepage.
Kn------------------ Kinross	Severe: wetness, floods.	Severe: wetness, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: wetness, too sandy, seepage.
Le------------------ Lenawee	Severe: percs slowly, wetness, floods.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
LrB*: Lenawee------------	Severe: percs slowly, wetness, floods.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Wixom---------------	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Fair: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
LxA Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
MeB Menominee	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: seepage.	Fair: too clayey.
OaB Oakville	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Pa Parkhill	Severe: wetness, percs slowly, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Pe Pella	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
PsB Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.
PtB Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, seepage, wetness.
PuB*: Pipestone	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: wetness, seepage.	Poor: too sandy, seepage, wetness.
Oakville	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: seepage.	Poor: too sandy.
Urban land.					
PwB Plainfield	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
PxB*: Poseyville	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Fair: too clayey.
Londo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
Sz Sloan	Severe: wetness, floods, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Ur*. Urban land					

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Wa------------------ Wauseon	Severe: percs slowly, wetness, floods.	Severe: seepage, wetness.	Severe: wetness, too clayey, floods.	Severe: wetness, seepage, floods.	Poor: wetness.
WxB----------------- Wixom	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Fair: too clayey.
WzB*:					
Wixom---------------	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Fair: too clayey.
Belleville----------	Severe: wetness, percs slowly, floods.	Severe: wetness, seepage, floods.	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Poor: wetness.
Urban land.					

* See map unit description for the composition and behavior of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AbB Abscota	Good	Good	Unsuited: excess fines.	Fair: too sandy.
Ad Adrian	Poor: excess humus, wetness.	Unsuited: excess humus.	Unsuited: excess fines, excess humus.	Poor: wetness, excess humus.
AeB*. Aquents				
Be Belleville	Poor: wetness, low strength.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: wetness.
BoB Bowers	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ch Cohoctah	Poor: wetness.	Good	Good	Poor: wetness.
CoB Covert	Fair: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
CsB Covert	Fair: thin layer, wetness.	Fair: thin layer.	Unsuited: excess fines.	Poor: too sandy.
InB Ingersoll	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Kg Kingsville	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
Kn Kinross	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness, too sandy.
Le Lenawee	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
LrB*: Lenawee	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Wixom	Poor: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
LxA Londo	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
MeB Menominee	Fair: shrink-swell.	Poor: thin layer.	Unsuited: excess fines.	Poor: too sandy.
OaB Oakville	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Pa Parkhill	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pe-------------------- Pella	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
PsB, PtB-------------- Pipestone	Poor: wetness.	Good----------------	Unsuited: excess fines.	Poor: too sandy, wetness.
PuB*:				
Pipestone------------	Poor: wetness.	Good----------------	Unsuited: excess fines.	Poor: too sandy, wetness.
Oakville-------------	Good----------------	Good----------------	Unsuited: excess fines.	Poor: too sandy.
Urban land.				
PwB------------------- Plainfield	Good----------------	Good----------------	Unsuited: excess fines.	Poor: too sandy.
PxB*:				
Poseyville-----------	Poor: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
Londo----------------	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Sz-------------------- Sloan	Poor: wetness, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Ur*. Urban land				
Wa-------------------- Wauseon	Poor: wetness, low strength, shrink-swell.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: wetness.
WxB------------------- Wixom	Poor: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
WzB*:				
Wixom----------------	Poor: low strength.	Poor: thin layer.	Unsuited: excess fines.	Fair: too sandy.
Belleville-----------	Poor: wetness, low strength.	Poor: excess fines, thin layer.	Unsuited: excess fines.	Poor: wetness.
Urban land.				

* See map unit description for the composition and behavior of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
AbB Abscota	Seepage	Seepage	Deep to water	Not needed	Fast intake, droughty, soil blowing.	Droughty.
Ad Adrian	Seepage	Seepage, wetness.	Favorable	Floods, frost action.	Wetness, fast intake, soil blowing.	Wetness.
AeB*. Aquents						
Be Belleville	Favorable	Wetness	Slow refill	Floods, frost action.	Wetness, fast intake, soil blowing.	Wetness.
BoB Bowers	Favorable	Unstable fill, low strength.	Slow refill	Frost action	Wetness	Wetness.
Ch Cohoctah	Seepage	Piping, seepage, wetness.	Favorable	Floods, frost action.	Wetness, floods, soil blowing.	Wetness.
CoB Covert	Seepage	Seepage	Deep to water	Favorable	Droughty, fast intake, wetness.	Droughty.
CsB Covert	Seepage	Seepage	Slow refill	Favorable	Wetness, droughty, soil blowing.	Droughty, percs slowly.
InB Ingersoll	Seepage	Piping, wetness.	Slow refill	Frost action	Wetness, erodes easily.	Wetness, erodes easily.
Kg Kingsville	Seepage	Seepage, wetness.	Favorable	Floods	Fast intake, wetness, droughty.	Wetness, droughty.
Kn Kinross	Seepage	Seepage, wetness.	Favorable	Floods	Wetness, fast intake, soil blowing.	Wetness.
Le Lenawee	Seepage	Wetness	Slow refill	Floods, frost action.	Wetness, floods.	Wetness.
LrB*:						
Lenawee	Seepage	Wetness	Slow refill	Floods, frost action.	Wetness, floods.	Wetness.
Wixom	Seepage	Wetness	Slow refill	Favorable	Fast intake, soil blowing, wetness.	Wetness, erodes easily.
LxA Londo	Favorable	Wetness	Slow refill	Frost action	Wetness	Wetness.
MeB Menominee	Favorable	Favorable	Deep to water, slow refill.	Favorable	Droughty, soil blowing.	Droughty.
OaB Oakville	Seepage	Piping, seepage.	Deep to water	Not needed	Fast intake, droughty, soil blowing.	Droughty.
Pa Parkhill	Seepage	Wetness	Slow refill	Floods, frost action.	Wetness, floods.	Wetness.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
Pe Pella	Seepage	Wetness	Slow refill	Floods, frost action.	Wetness, floods.	Wetness.
PsB Pipestone	Seepage	Seepage, piping.	Favorable	Favorable	Fast intake, wetness, droughty.	Droughty, wetness.
PtB Pipestone	Seepage	Seepage, piping.	Slow refill, cutbanks cave.	Favorable	Fast intake, wetness, droughty.	Droughty, wetness.
PuB*: Pipestone	Seepage	Seepage, piping.	Favorable	Favorable	Fast intake, wetness, droughty.	Droughty, wetness.
Oakville	Seepage	Piping, seepage.	Deep to water	Not needed	Fast intake, droughty, soil blowing.	Droughty.
Urban land.						
PwB Plainfield	Seepage	Seepage	No water	Not needed	Droughty, fast intake, soil blowing.	Droughty.
PxB*: Poseyville	Seepage	Wetness	Slow refill	Frost action	Wetness, fast intake, soil blowing.	Wetness, erodes easily.
Londo	Favorable	Wetness	Slow refill	Frost action	Wetness	Wetness.
Sz Sloan	Favorable	Piping	Favorable	Wetness, floods, poor outlets.	Wetness, floods.	Wetness.
Ur*. Urban land						
Wa Wauseon	Seepage	Wetness, hard to pack.	Slow refill	Percs slowly, frost action, floods.	Wetness, droughty, soil blowing.	Wetness, percs slowly, droughty.
WxB Wixom	Seepage	Wetness	Slow refill	Favorable	Fast intake, soil blowing, wetness.	Wetness, erodes easily.
WzB*: Wixom	Seepage	Wetness	Slow refill	Favorable	Fast intake, soil blowing, wetness.	Wetness, erodes easily.
Belleville	Favorable	Wetness	Slow refill	Floods, frost action.	Wetness, fast intake, soil blowing.	Wetness.
Urban land.						

* See map unit description for the composition and behavior of the map unit.

TABLE 13.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
AbB------------------- Abscota	Severe: floods.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Ad-------------------- Adrian	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, excess humus.
AeB*. Aquents				
Be-------------------- Belleville	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
BoB------------------- Bowers	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Ch-------------------- Cohoctah	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
CoB, CsB-------------- Covert	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
InB------------------- Ingersoll	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Kg-------------------- Kingsville	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Kn-------------------- Kinross	Severe: floods, wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness, floods.	Severe: wetness, too sandy.
Le-------------------- Lenawee	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
LrB*:				
Lenawee---------------	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Wixom-----------------	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
LxA------------------- Londo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
MeB------------------- Menominee	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
OaB------------------- Oakville	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Pa-------------------- Parkhill	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Pe Pella	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
PsB, PtB Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.
PuB*: Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: too sandy.
Oakville	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Urban land.				
PwB Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
PxB*: Poseyville	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
Londo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Sz Sloan	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Ur*. Urban land				
Wa Wauseon	Severe: wetness, percs slowly, floods.	Severe: wetness.	Severe: wetness, percs slowly, floods.	Severe: wetness.
WxB Wixom	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
WzB*: Wixom	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
Belleville	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Urban land.				

* See map unit description for the composition and behavior of the map unit.

TABLE 14.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AbB----------------- Abscota	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Ad------------------ Adrian	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
AeB*. Aquents										
Be------------------ Belleville	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair.
BoB----------------- Bowers	Fair	Good	Good	Good	Fair	Good	Fair	Good	Good	Fair.
Ch------------------ Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
CoB, CsB------------ Covert	Poor	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
InB----------------- Ingersoll	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Kg------------------ Kingsville	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Kn------------------ Kinross	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
Le------------------ Lenawee	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
LrB*:										
Lenawee-------------	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Wixom---------------	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
LxA----------------- Londo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
MeB----------------- Menominee	Poor	Poor	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
OaB----------------- Oakville	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Pa------------------ Parkhill	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Pe------------------ Pella	Good	Good	Good	Fair	Poor	Fair	Fair	Good	Fair	Fair.
PsB----------------- Pipestone	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.
PtB----------------- Pipestone	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
PuB*:										
Pipestone-----------	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor.

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
PuB*:										
Oakville	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Urban land.										
PwB Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PxB*:										
Poseyville	Poor	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
Londo	Fair	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
Sz Sloan	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ur*. Urban land										
Wa Wauseon	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
WxB Wixom	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
WzB*:										
Wixom	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Belleville	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair.
Urban land.										

* See map unit description for the composition and behavior of the map unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AbB---------------- Abscota	0-5	Loamy sand------	SM	A-2-4, A-1	0	95-100	95-100	50-75	15-30	---	NP
	5-22	Sand------------	SP, SM	A-2-4, A-1, A-3	0	95-100	95-100	45-65	0-15	---	NP
	22-60	Sand, coarse sand.	SM, SP-SM	A-1, A-3, A-2-4	0	95-100	95-100	45-60	0-10	---	NP
Ad-----------------	0-24	Sapric material	Pt	A-8	---	---	---	---	---	---	---
Adrian	24-60	Sand, loamy sand	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
AeB*. Aquents											
Be------------------	0-8	Loamy sand------	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
Belleville	8-30	Sand, loamy sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	30-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
BoB----------------	0-9	Silt loam-------	ML, CL-ML	A-4	0	100	100	85-95	60-95	25-37	4-10
Bowers	9-55	Silty clay loam, silty clay.	CL	A-6	0	100	100	95-100	85-95	27-37	11-16
	55-60	Stratified silty clay to silt loam.	CL	A-6, A-4, A-7	0	100	100	90-100	70-95	27-45	9-25
Ch-----------------	0-10	Fine sandy loam	ML, SM	A-4, A-2	0	100	100	65-95	30-75	20-30	NP-6
Cohoctah	10-38	Loam, fine sandy loam, sandy loam.	ML, SM, CL, SC	A-4, A-2	0	100	100	70-90	30-70	20-30	NP-10
	38-60	Sand, gravelly loamy sand, gravelly sand.	SP-SM, SP, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-90	35-85	30-60	0-10	---	NP
CoB---------------- Covert	0-5	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	5-28	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	28-60	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
CsB---------------- Covert	0-8	Sand------------	SM, SP-SM	A-2-4, A-3	0	95-100	90-100	50-75	5-25	---	NP
	8-43	Sand------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	43-60	Clay loam, loam, silty clay.	CL, CL-ML, CH, ML	A-4, A-6, A-7	0-5	90-100	90-100	75-100	50-90	17-60	3-34
InB----------------	0-9	Silt loam-------	CL-ML, ML	A-4	0	95-100	95-100	95-100	75-95	25-38	4-10
Ingersoll	9-12	Silt loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	70-95	20-38	6-20
	12-60	Stratified very fine sand to silty clay loam.	ML, SM, CL, SC	A-4	0	95-100	95-100	75-95	36-90	<30	NP-10
Kg-----------------	0-6	Loamy fine sand	SM	A-2	0	100	90-100	80-95	20-35	---	NP
Kingsville	6-60	Fine sand, loamy fine sand.	SM	A-2	0	100	90-100	80-95	20-35	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Kn----------------- Kinross	5-0	Muck------------	Pt	A-8	0	---	---	---	---	---	
	0-3	Mucky sand------	SP	A-3	0	100	100	80-95	0-5	---	NP
	3-60	Sand------------	SP	A-3	0	100	95-100	80-95	0-5	---	NP
Le----------------- Lenawee	0-9	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	50-95	25-45	11-22
	9-40	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-95	25-55	11-30
	40-60	Silt loam, silty clay loam, silty clay.	CL, CL-ML	A-6, A-4, A-7	0	100	95-100	95-100	85-95	25-45	6-22
LrB*:											
Lenawee-----------	0-9	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	50-95	25-45	11-22
	9-40	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-95	25-55	11-30
	40-60	Silt loam, silty clay loam, silty clay.	CL, CL-ML	A-6, A-4, A-7	0	100	95-100	95-100	85-95	25-45	6-22
Wixom-------------	0-9	Loamy sand------	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	9-29	Loamy sand, sand, loamy sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	29-60	Silty clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25
LxA---------------- Londo	0-9	Loam------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	9-19	Clay loam, loam	CL	A-6	0	95-100	90-100	85-95	65-80	25-40	11-25
	19-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	25-35	5-15
MeB---------------- Menominee	0-8	Sand------------	SM, SP-SM	A-2-4	0	95-100	95-100	50-75	10-30	---	NP
	8-26	Sand, loamy sand	SP, SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	0-15	---	NP
	26-60	Clay loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-10	85-95	85-95	80-95	60-90	25-40	5-20
OaB---------------- Oakville	0-14	Fine sand-------	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	14-60	Fine sand-------	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
Pa----------------- Parkhill	0-14	Loam------------	CL-ML, CL	A-4, A-6	0-5	95-100	90-100	85-95	60-85	20-40	6-18
	14-25	Clay loam, loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	85-100	65-95	25-40	10-20
	25-60	Loam------------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-90	60-75	15-35	5-15
Pe----------------- Pella	0-12	Silt loam-------	CL	A-6, A-7	0	100	95-100	85-100	70-95	25-50	15-30
	12-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	70-95	30-50	15-30
	30-60	Stratified sandy loam to silty clay loam.	SM-SC, SC, CL, CL-ML	A-2, A-4, A-6	0-5	90-100	80-100	50-100	30-85	20-35	7-20
PsB---------------- Pipestone	0-6	Sand------------	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	6-24	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	24-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
PtB---------------- Pipestone	0-8	Sand------------	SP-SM, SM	A-1, A-2-4, A-3	0	95-100	90-100	40-75	5-30	---	NP
	8-52	Sand, fine sand, loamy fine sand.	SP, SP-SM, SM	A-1, A-2-4, A-3	0	95-100	90-100	40-75	2-30	---	NP
	52-60	Clay loam, loam, silty clay.	CL, CH, ML	A-4, A-6, A-7	0-5	90-100	90-100	75-100	50-90	25-60	3-34
PuB*: Pipestone---------	0-6	Sand------------	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	6-24	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	24-60	Sand, fine sand	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
Oakville----------	0-14	Fine sand-------	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	14-60	Fine sand-------	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
Urban land.											
PwB---------------- Plainfield	0-6	Sand------------	SP-SM, SM	A-3, A-2	0	100	100	50-80	5-35	---	NP
	6-60	Sand------------	SP	A-3	0	100	100	55-65	1-4	---	NP
PxB*: Poseyville--------	0-16	Loamy sand, sand	SM	A-2-4, A-1	0-2	95-100	90-100	45-75	10-30	---	NP
	16-23	Sandy loam, fine sandy loam.	SM, SM-SC	A-2-4, A-4	0-2	95-100	90-100	55-85	25-50	<25	NP-5
	23-60	Loam, clay loam	CL	A-4, A-6	0-2	95-100	90-100	80-100	60-80	25-36	8-18
Londo-------------	0-9	Loam------------	ML, CL-ML, CL	A-4	0	95-100	90-100	75-95	50-75	20-30	2-10
	9-19	Clay loam, loam	CL	A-6	0	95-100	90-100	85-95	65-80	25-40	11-25
	19-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	80-90	55-75	25-35	5-15
Sz----------------- Sloan	0-30	Loam------------	CL, ML	A-6, A-4, A-7	0	100	95-100	85-100	70-95	30-45	8-15
	30-40	Silty clay loam, clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	40-60	Stratified sandy loam to silty clay loam.	ML, CL SM, SC	A-4, A-6	0	95-100	90-100	60-95	35-90	15-40	NP-15
Ur*. Urban land											
Wa----------------- Wauseon	0-8	Sandy loam	SM, ML	A-2, A-4	0	100	95-100	70-85	25-55	<35	NP-8
	8-35	Sandy loam, loamy fine sand, very fine sand.	SM	A-2, A-4	0	100	95-100	65-95	20-45	---	NP
	35-60	Clay, silty clay, silty clay loam.	CH, CL, MH, ML	A-7	0	100	95-100	90-100	80-95	42-70	18-36

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WxB---------------- Wixom	0-9	Loamy sand------	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	9-29	Loamy sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	29-60	Silty clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25
WzB*:											
Wixom-------------	0-9	Loamy sand------	SM	A-2-4	0	95-100	95-100	50-70	15-30	---	NP
	9-29	Loamy sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<20	NP-4
	29-60	Silty clay loam, sandy clay loam, loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	51-95	20-40	5-25
Belleville---------	0-8	Loamy sand------	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	8-30	Sand, loamy sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	30-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
Urban land.											

---

* See map unit description for the composition and behavior of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Wind erodibility group is for the surface layer. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
AbB	0-5	6.0-20	0.08-0.12	6.1-6.5	Low	0.17	5	2
Abscota	5-22	6.0-20	0.05-0.07	6.1-7.8	Low	0.17		
	22-60	6.0-20	0.05-0.07	6.1-8.4	Low	0.17		
Ad	0-24	0.2-6.0	0.35-0.45	5.1-7.8	---	0.10	5	3
Adrian	24-60	6.0-20	0.03-0.08	6.1-8.4	Low	---		
AeB*.								
Aquents								
Be	0-8	6.0-20	0.10-0.12	6.1-7.8	Low	0.17	5	2
Belleville	8-30	6.0-20	0.06-0.10	6.1-8.4	Low	0.17		
	30-60	0.2-0.6	0.14-0.20	7.4-8.4	Moderate	0.32		
BoB	0-9	0.6-2.0	0.20-0.22	5.6-7.8	Low	0.32	5	5
Bowers	9-55	0.2-0.6	0.18-0.20	6.1-7.8	Moderate	0.32		
	55-60	0.2-0.6	0.18-0.22	7.9-8.4	Moderate	0.32		
Ch	0-10	2.0-6.0	0.13-0.22	6.1-7.8	Low	0.28	5	3
Cohoctah	10-38	2.0-6.0	0.12-0.20	6.1-8.4	Low	0.28		
	38-60	>20	0.02-0.07	7.9-8.4	Low	0.10		
CoB	0-5	6.0-20	0.06-0.09	4.5-7.3	Low	0.15	5	1
Covert	5-28	6.0-20	0.05-0.08	4.5-7.3	Low	0.15		
	28-60	>20	0.04-0.07	5.6-7.3	Low	0.15		
CsB	0-8	6.0-20	0.06-0.09	4.5-7.3	Low	0.15	5	1
Covert	8-43	6.0-20	0.05-0.08	4.5-7.3	Low	0.15		
	43-60	0.06-0.6	0.10-0.18	7.4-8.4	Moderate	0.32		
InB	0-9	0.6-6.0	0.20-0.24	6.1-7.8	Low	0.37	5	5
Ingersoll	9-12	0.6-2.0	0.15-0.22	6.1-7.8	Low	0.37		
	12-60	0.6-2.0	0.14-0.20	7.4-8.4	Low	0.37		
Kg	0-6	6.0-20	0.07-0.12	6.1-8.4	Low	0.17	5	1
Kingsville	6-60	6.0-20	0.07-0.12	6.5-8.4	Low	0.17		
Kn	5-0	0.2-6.0	0.35-0.45	4.5-5.5	---	---		
Kinross	0-3	>20	0.04-0.06	4.5-5.5	Low	---	5	3
	3-60	>20	0.04-0.06	5.1-6.0	Low	---		
Le	0-9	0.6-2.0	0.17-0.22	5.6-6.0	Moderate	0.28	4	7
Lenawee	9-40	0.2-0.6	0.18-0.20	6.6-7.8	Moderate	0.28		
	40-60	0.6-2.0	0.18-0.22	7.4-7.8	Low	0.28		
LrB*:								
Lenawee	0-9	0.6-2.0	0.17-0.22	5.6-6.0	Moderate	0.28	4	7
	9-40	0.2-0.6	0.18-0.20	6.6-7.8	Moderate	0.28		
	40-60	0.6-2.0	0.18-0.22	7.4-7.8	Low	0.28		
Wixom	0-9	6.0-20	0.10-0.12	5.1-6.5	Low	0.15	3	2
	9-29	6.0-20	0.06-0.11	5.1-6.5	Low	0.15		
	29-60	0.2-0.6	0.14-0.20	6.1-7.8	Moderate	0.43		
LxA	0-9	0.6-2.0	0.18-0.24	6.1-7.8	Low	0.32	5	6
Londo	9-19	0.2-2.0	0.14-0.19	6.6-7.8	Moderate	0.32		
	19-60	0.2-2.0	0.12-0.19	7.9-8.4	Moderate	0.32		
MeB	0-8	6.0-20	0.08-0.12	5.1-6.5	Low	0.17	5	2
Menominee	8-26	6.0-20	0.04-0.10	5.1-6.5	Low	0.17		
	26-60	0.2-0.6	0.14-0.18	5.6-7.8	Moderate	0.32		
OaB	0-14	>20.0	0.07-0.09	5.6-7.3	Low	0.15	5	1
Oakville	14-60	>20.0	0.06-0.08	5.6-7.3	Low	0.15		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
Pa Parkhill	0-14	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.28	5	5
	14-25	0.2-0.6	0.15-0.19	6.1-7.8	Low	0.28		
	25-60	0.6-2.0	0.17-0.19	7.4-8.4	Low	0.28		
Pe Pella	0-12	0.6-2.0	0.22-0.24	6.1-7.8	Moderate	0.28	5	6
	12-30	0.6-2.0	0.21-0.24	7.4-8.4	Moderate	0.28		
	30-60	0.6-2.0	0.10-0.22	7.4-8.4	Low	0.28		
PsB Pipestone	0-6	6.0-20	0.07-0.10	4.5-7.3	Low	0.17	5	1
	6-24	6.0-20	0.06-0.09	4.5-7.3	Low	0.17		
	24-60	>20	0.05-0.07	5.1-7.3	Low	0.17		
PtB Pipestone	0-8	6.0-20	0.06-0.10	4.5-7.3	Very low	0.17	5	1
	8-52	6.0-20	0.04-0.08	4.5-7.3	Very low	0.17		
	52-60	0.06-0.6	0.16-0.18	7.4-8.4	Moderate	0.32		
PuB*:								
Pipestone	0-6	6.0-20	0.07-0.10	4.5-7.3	Low	0.17	5	1
	6-24	6.0-20	0.06-0.09	4.5-7.3	Low	0.17		
	24-60	>20	0.05-0.07	5.1-7.3	Low	0.17		
Oakville	0-14	>20.0	0.07-0.09	5.6-7.3	Low	0.15	5	1
	14-60	>20.0	0.06-0.08	5.6-7.3	Low	0.15		
Urban land.								
PwB Plainfield	0-6	6.0-20	0.06-0.09	4.5-6.0	Low	0.17	5	1
	6-60	6.0-20	0.05-0.07	4.5-6.0	Low	0.17		
PxB*:								
Poseyville	0-16	6.0-20	0.04-0.12	6.1-7.3	Very low	0.17	5	2
	16-23	6.0-20	0.06-0.14	6.6-7.8	Low	0.17		
	23-60	0.2-2.0	0.12-0.19	7.9-8.4	Moderate	0.37		
Londo	0-9	0.6-2.0	0.18-0.24	6.1-7.8	Low	0.32	5	6
	9-19	0.2-2.0	0.14-0.19	6.6-7.8	Moderate	0.32		
	19-60	0.2-2.0	0.12-0.19	7.9-8.4	Moderate	0.32		
Sz Sloan	0-30	0.6-2.0	0.20-0.24	6.1-7.8	Moderate	0.37	5	6
	30-40	0.2-2.0	0.11-0.19	6.1-8.4	Moderate	0.37		
	40-60	0.2-2.0	0.11-0.18	6.6-8.4	Low	0.37		
Ur*. Urban land								
Wa Wauseon	0-8	2.0-6.0	0.12-0.18	6.1-7.3	Low	0.20	5	3
	8-35	6.0-20	0.06-0.10	6.6-7.8	Low	0.20		
	35-60	<0.06	0.06-0.10	7.4-7.8	High	0.20		
WxB Wixom	0-9	6.0-20	0.10-0.12	5.1-6.5	Low	0.15	3	2
	9-29	6.0-20	0.06-0.11	5.1-6.5	Low	0.15		
	29-60	0.2-0.6	0.14-0.20	6.1-7.8	Moderate	0.43		
WzB*:								
Wixom	0-9	6.0-20	0.10-0.12	5.1-6.5	Low	0.15	3	2
	9-29	6.0-20	0.06-0.11	5.1-6.5	Low	0.15		
	29-60	0.2-0.6	0.14-0.20	6.1-7.8	Moderate	0.43		
Belleville	0-8	6.0-20	0.10-0.12	6.1-7.8	Low	0.17	5	2
	8-30	6.0-20	0.06-0.10	6.1-8.4	Low	0.17		
	30-60	0.2-0.6	0.14-0.20	7.4-8.4	Moderate	0.32		
Urban land.								

* See map unit description for the composition and behavior of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
AbB Abscota	A	Common	Brief	Mar-Jun	2.5-5.0	Apparent	Dec-May	---	---	Moderate	Low	Low.
Ad Adrian	A/D	Frequent	Long	Nov-May	0-1.0	Apparent	Nov-May	---	25-30	High	High	Moderate.
AeB*. Aquents												
Be Belleville	B/D	Frequent	Brief	Mar-Apr	0-1.0	Apparent	Mar-May	---	---	High	High	Low.
BoB Bowers	C	None	---	---	1.0-2.0	Apparent	Nov-Apr	---	---	High	High	Low.
Ch Cohoctah	B/D	Common	Long	Jan-Dec	0-1.0	Apparent	Sep-May	---	---	High	High	Low.
CoB Covert	A	None	---	---	1.5-3.5	Apparent	Nov-Apr	---	---	Low	Low	Moderate.
CsB Covert	A	None	---	---	1.5-3.5	Apparent	Nov-May	---	---	Low	High	Moderate.
InB Ingersoll	B	None	---	---	1.0-2.0	Apparent	Nov-May	---	---	High	High	Low.
Kg Kingsville	C	Frequent	Brief	Oct-May	0-1.0	Apparent	Jan-Apr	---	---	Moderate	High	High.
Kn Kinross	A/D	Frequent	Brief	Sep-May	0-1.0	Apparent	Sep-Jun	---	4-6	Moderate	High	Low.
Le Lenawee	B/D	Frequent	Brief	Mar-May	0-1.0	Apparent	Nov-May	---	---	High	High	Low.
LrB*: Lenawee	B/D	Frequent	Brief	Mar-May	0-1.0	Apparent	Nov-May	---	---	High	High	Low.
Wixom	B	None	---	---	1.0-2.0	Perched	Nov-Jun	---	---	Moderate	High	Moderate.
LxA Londo	C	None	---	---	1.0-2.0	Apparent	Nov-May	---	---	High	High	Low.
MeB Menominee	A	None	---	---	>2.5	Apparent	Dec-Apr	---	---	Low	Low	Moderate.
OaB Oakville	A	None	---	---	>3.0	Apparent	Nov-Apr	---	---	Low	Low	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
Pa---------------- Parkhill	B/D	Frequent----	Brief-----	Mar-Apr	0-1.5	Apparent	Nov-May	---	---	High-----	High-----	Low.
Pe---------------- Pella	B/D	Occasional	Brief-----	Mar-Jun	0-2.0	Apparent	Mar-Jun	---	---	High-----	High-----	Moderate.
PsB--------------- Pipestone	A	None---------	---	---	0.5-1.5	Apparent	Oct-Jun	---	---	Moderate	Low------	Moderate.
PtB--------------- Pipestone	C	None---------	---	---	0.5-1.5	Apparent	Nov-May	---	---	Moderate	High-----	Moderate.
PuB*: Pipestone--------	A	None---------	---	---	0.5-1.5	Apparent	Oct-Jun	---	---	Moderate	Low------	Moderate.
Oakville---------	A	None---------	---	---	>3.0	Apparent	Nov-Apr	---	---	Low------	Low------	Moderate.
Urban land.												
PwB--------------- Plainfield	A	None---------	---	---	>6.0	---	---	---	---	Low------	Low------	High.
PxB*: Poseyville-------	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	---	High-----	High-----	Moderate.
Londo------------	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	---	High-----	High-----	Low.
Sz---------------- Sloan	B/D	Frequent----	Very brief	Nov-Jun	0-0.5	Apparent	Nov-Jun	---	---	High-----	High-----	Low.
Ur*. Urban land												
Wa---------------- Wauseon	B/D	Frequent----	Brief-----	Nov-May	0-0.5	Perched	Jan-Apr	---	---	High-----	High-----	Low.
WxB--------------- Wixom	B	None---------	---	---	1.0-2.0	Perched	Nov-Jun	---	---	Moderate	High-----	Moderate.
WzB*: Wixom------------	B	None---------	---	---	1.0-2.0	Perched	Nov-Jun	---	---	Moderate	High-----	Moderate.
Belleville-------	B/D	Frequent----	Brief-----	Mar-Apr	0-1.0	Apparent	Mar-May	---	---	High-----	High-----	Low.
Urban land.												

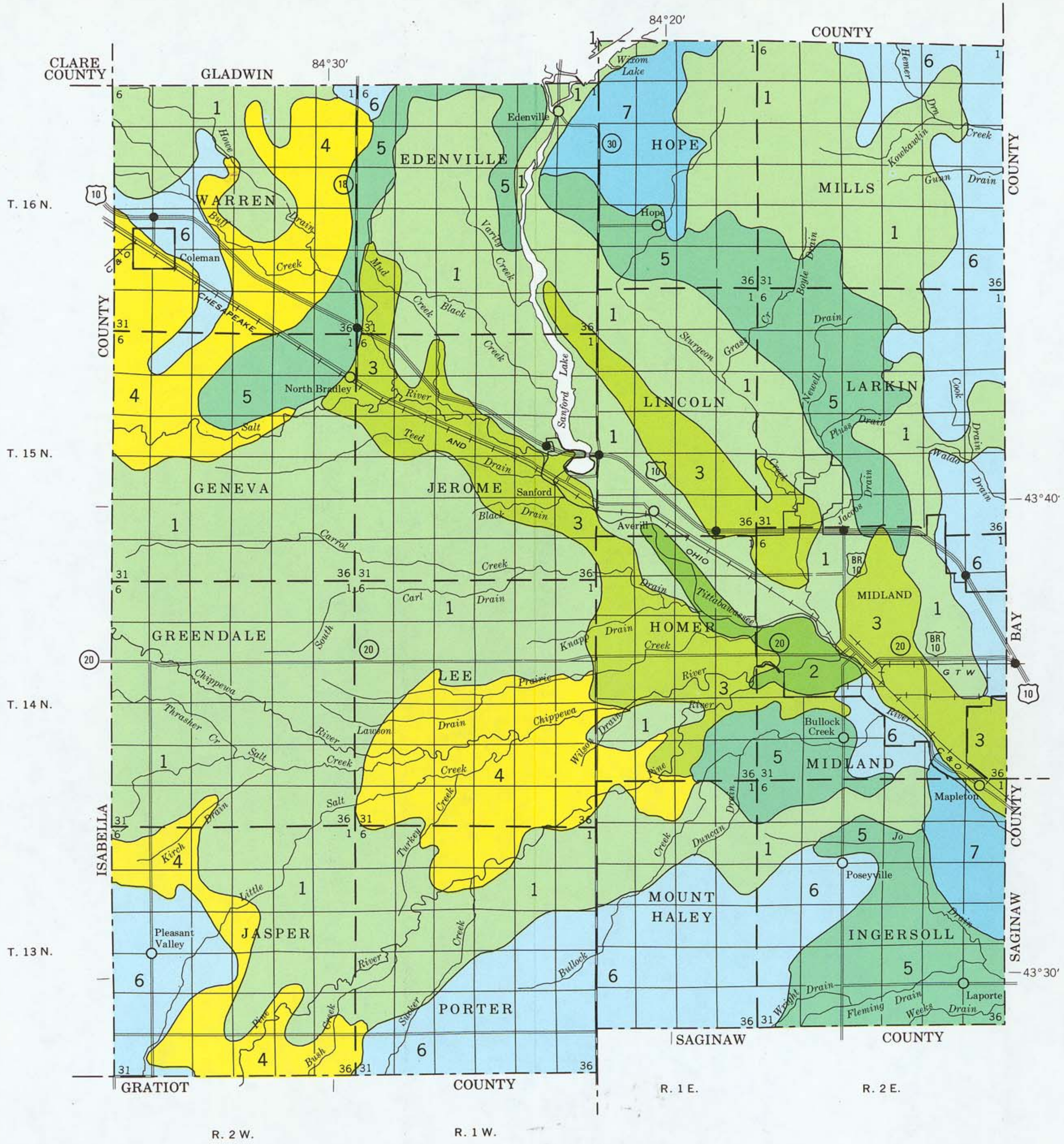
* See map unit description for the composition and behavior of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Abscota	Mixed, mesic Typic Udipsamments
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
*Bowers	Fine, mixed Aquic Eutroboralfs
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Covert	Sandy, mixed, mesic Entic Haplorthods
Ingersoll	Fine-silty, mixed, mesic Aquic Hapludalfs
*Kingsville	Mixed, mesic Mollic Psammaquents
*Kinross	Sandy, mixed, frigid Typic Haplaquods
Lenawee	Fine, mixed, nonacid, mesic Mollic Haplaquepts
Londo	Fine-loamy, mixed, mesic Aeric Glossaqualfs
*Menominee	Sandy over loamy, mixed, frigid Alfic Haplorthods
Oakville	Mixed, mesic Typic Udipsamments
Parkhill	Fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts
*Pella	Fine-silty, mixed, mesic Typic Haplaquolls
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Plainfield	Mixed, mesic Typic Udipsamments
Poseyville	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Wauseon	Coarse-loamy over clayey, mixed, mesic Typic Haplaquolls
Wixom	Sandy over loamy, mixed, mesic Alfic Haplaquods

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979 -255-735/102


84°20′
84°30′
CLARE COUNTY
GLADWIN
COUNTY
BAY
COUNTY
SAGINAW
COUNTY
GRATIOT
COUNTY
ISABELLA
COUNTY
T. 16 N.
T. 15 N.
T. 14 N.
T. 13 N.
R. 2 W.
R. 1 W.
R. 1 E.
R. 2 E.
43°40′
43°30′
WARREN
EDENVILLE
HOPE
MILLS
GENEVA
JEROME
LINCOLN
LARKIN
GREENDALE
LEE
HOMER
MIDLAND
JASPER
PORTER
MOUNT HALEY
INGERSOLL
Coleman
North Bradley
Edenville
Hope
Sanford
Averill
Midland
Bullock Creek
Mapleton
Poseyville
Pleasant Valley
Laporte
Wixom Lake
Sanford Lake
Tittabawassee River
Chippewa River
Salt River
Pine River
Chesapeake and Ohio
C & O
G T W
10
18
20
30
BR 10

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GENERAL SOIL MAP

MIDLAND COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 4 Miles

SOIL LEGEND

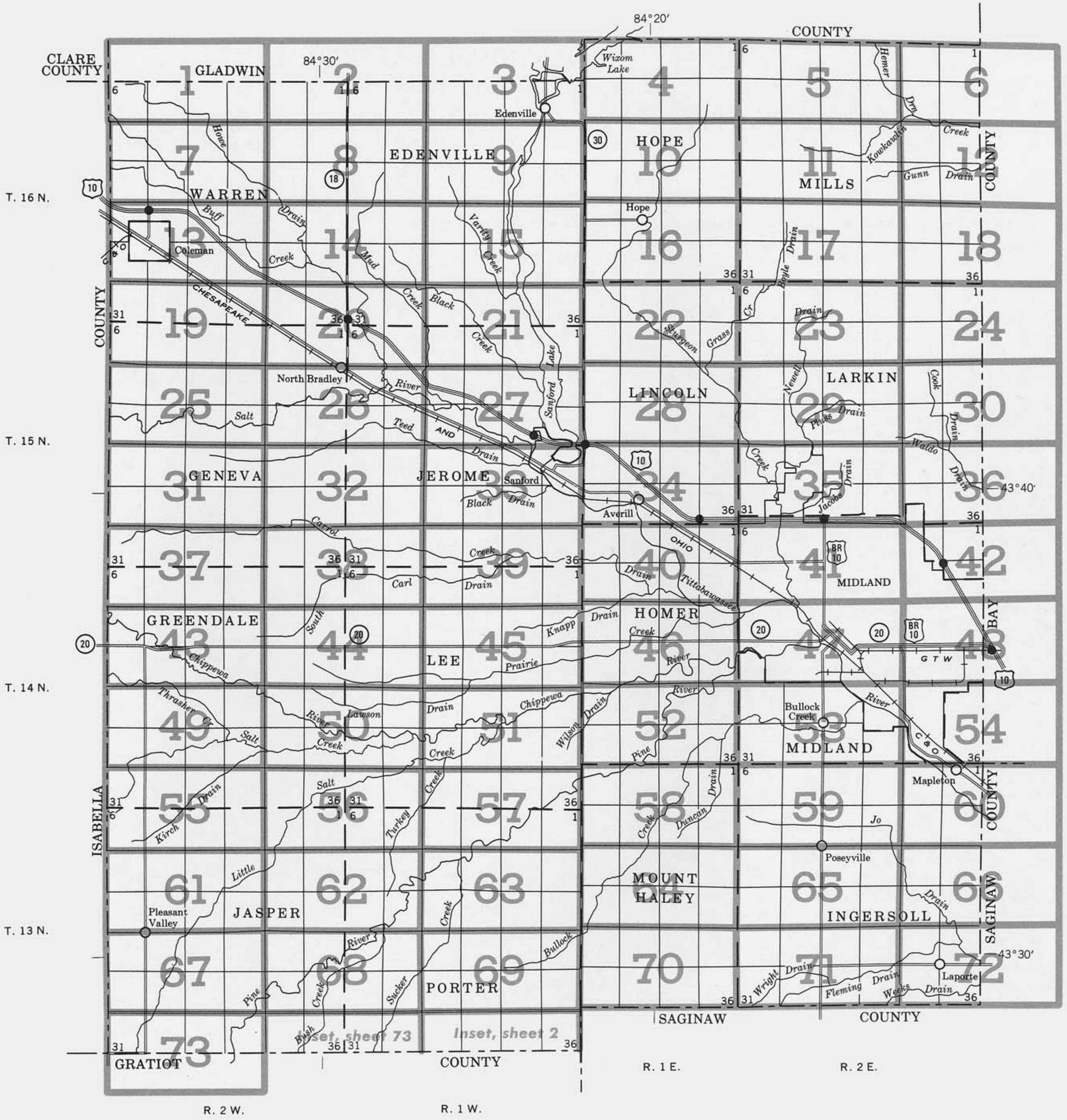
1	Kingsville–Pipestone–Covert: Nearly level and gently sloping, poorly drained to moderately well drained soils that have a sandy subsoil or upper substratum; formed in outwash or glacial lake deposits
2	Cohoctah–Sloan: Nearly level, poorly drained and very poorly drained soils that have a loamy subsoil or upper substratum; formed in loamy or sandy and gravelly alluvial deposits
3	Belleville–Wixom: Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a sandy and loamy subsoil or a sandy upper substratum; formed in glaciofluvial material over till or glacial lake deposits
4	Wixom–Belleville–Pipestone: Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a sandy or loamy subsoil or a sandy upper substratum; formed in glaciofluvial material over till and glacial lake deposits
5	Lenawee–Bowers–Wixom: Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a loamy and clayey subsoil or a sandy and loamy subsoil; formed in glaciolacustrine and till deposits
6	Parkhill–Londo: Nearly level and gently sloping, very poorly drained to somewhat poorly drained soils that have a loamy subsoil; formed in glacial till deposits
7	Ingersoll–Pella: Nearly level and gently sloping, poorly drained and somewhat poorly drained soils that have a loamy subsoil; formed in glaciolacustrine and glaciofluvial deposits

Compiled 1978

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.


84°20′
84°30′
COUNTY
CLARE COUNTY
GLADWIN
ISABELLA COUNTY
GRATIOT COUNTY
SAGINAW COUNTY
BAY COUNTY
SAGINAW COUNTY
T. 16 N.
T. 15 N.
T. 14 N.
T. 13 N.
R. 2 W.
R. 1 W.
R. 1 E.
R. 2 E.
43°40′
43°30′
WARREN
EDENVILLE
HOPE
MILLS
GENEVA
JEROME
LINCOLN
LARKIN
GREENDALE
LEE
HOMER
MIDLAND
JASPER
PORTER
MOUNT HALEY
INGERSOLL
Coleman
Edenville
Hope
North Bradley
Sanford
Averill
Midland
Bullock Creek
Mapleton
Poseyville
Pleasant Valley
Laporte
Wizom Lake
Inset, sheet 73
Inset, sheet 2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73

INDEX TO MAP SHEETS

MIDLAND COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 4 Miles

N

SECTIONALIZED TOWNSHIP

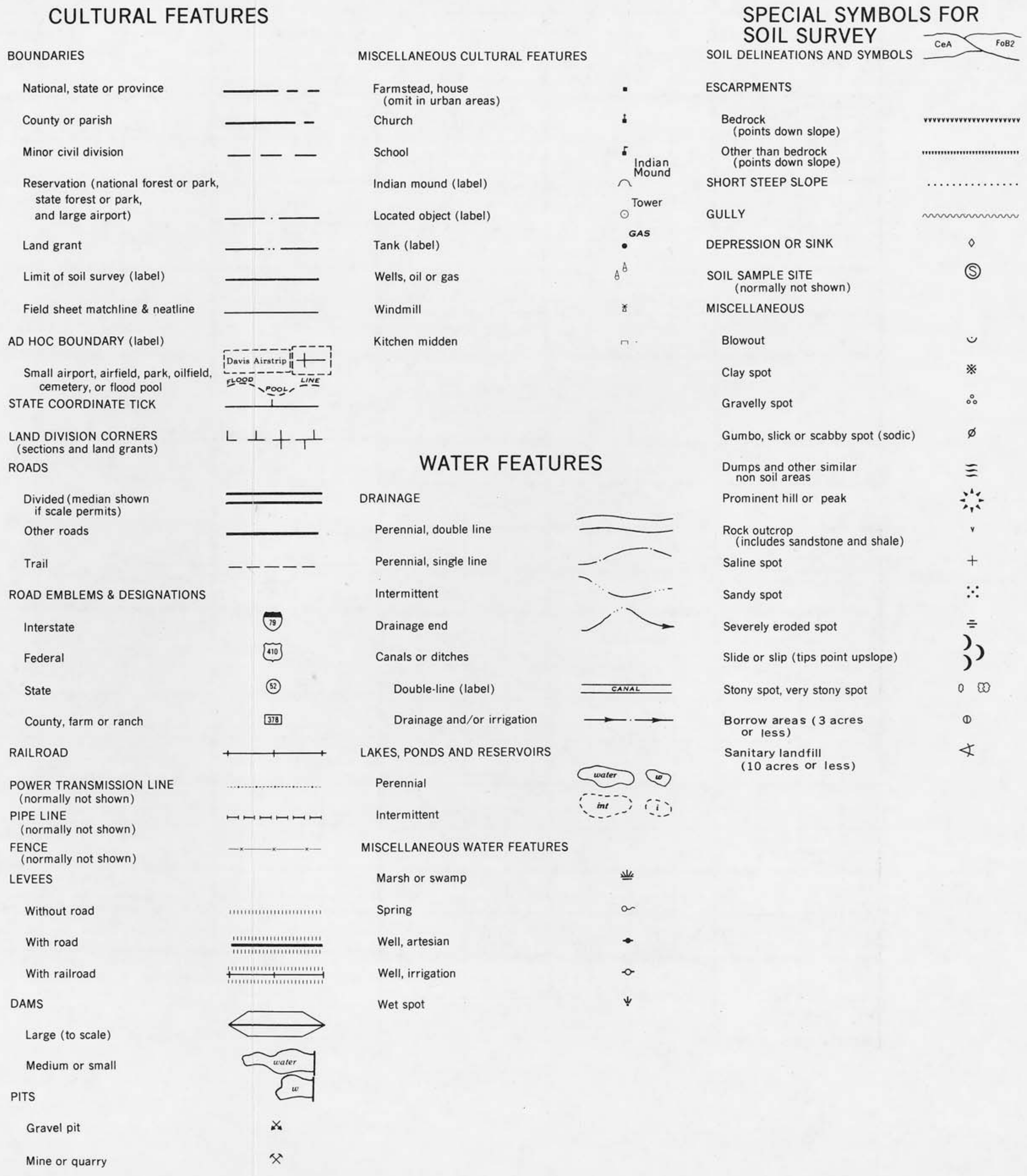
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Each symbol consists of two or three letters, for example, Be, AbB, or AeB. If the slope is given in the soil name, the third letter A or B indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
AbB	Abscota loamy sand, 0 to 6 percent slopes
Ad	Adrian muck
AeB	Aquents
Be	Belleville loamy sand
BoB	Bowers silt loam, 0 to 3 percent slopes
Ch	Cohoctah fine sandy loam, gravelly substratum
CoB	Covert sand, 0 to 6 percent slopes
CsB	Covert sand, loamy substratum, 0 to 6 percent slopes
InB	Ingersoll silt loam, 0 to 3 percent slopes
Kg	Kingsville loamy fine sand
Kn	Kinross mucky sand
Le	Lenawee silty clay loam
LrB	Lenawee–Wixom complex, 0 to 4 percent slopes
LxA	Londo loam, 0 to 3 percent slopes
MeB	Menominee sand, 2 to 6 percent slopes
OaB	Oakville fine sand, 0 to 6 percent slopes
Pa	Parkhill loam
Pe	Pella silt loam
PsB	Pipestone sand, 0 to 3 percent slopes
PtB	Pipestone sand, loamy substratum, 0 to 3 percent slopes
PuB	Pipestone–Oakville–Urban land complex, 0 to 6 percent slopes
PwB	Plainfield sand, 0 to 6 percent slopes
PxB	Poseyville–Londo complex, 0 to 4 percent slopes
Sz	Sloan loam
Ur	Urban land
Wa	Wauseon sandy loam
WxB	Wixom loamy sand, 0 to 3 percent slopes
WzB	Wixom–Belleville–Urban land complex, 0 to 3 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND



CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

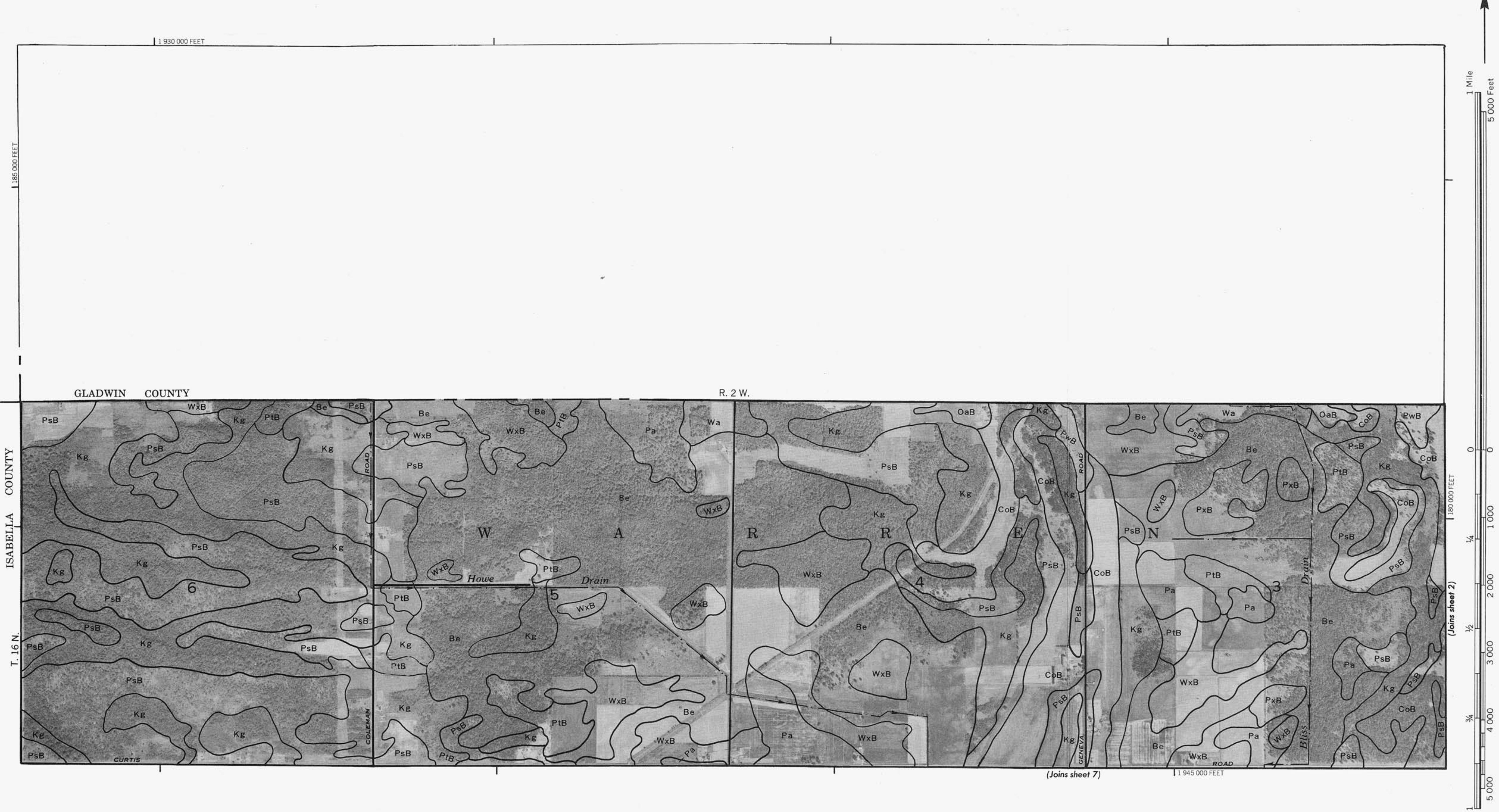
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Borrow areas (3 acres or less)
- Sanitary landfill (10 acres or less)

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 1

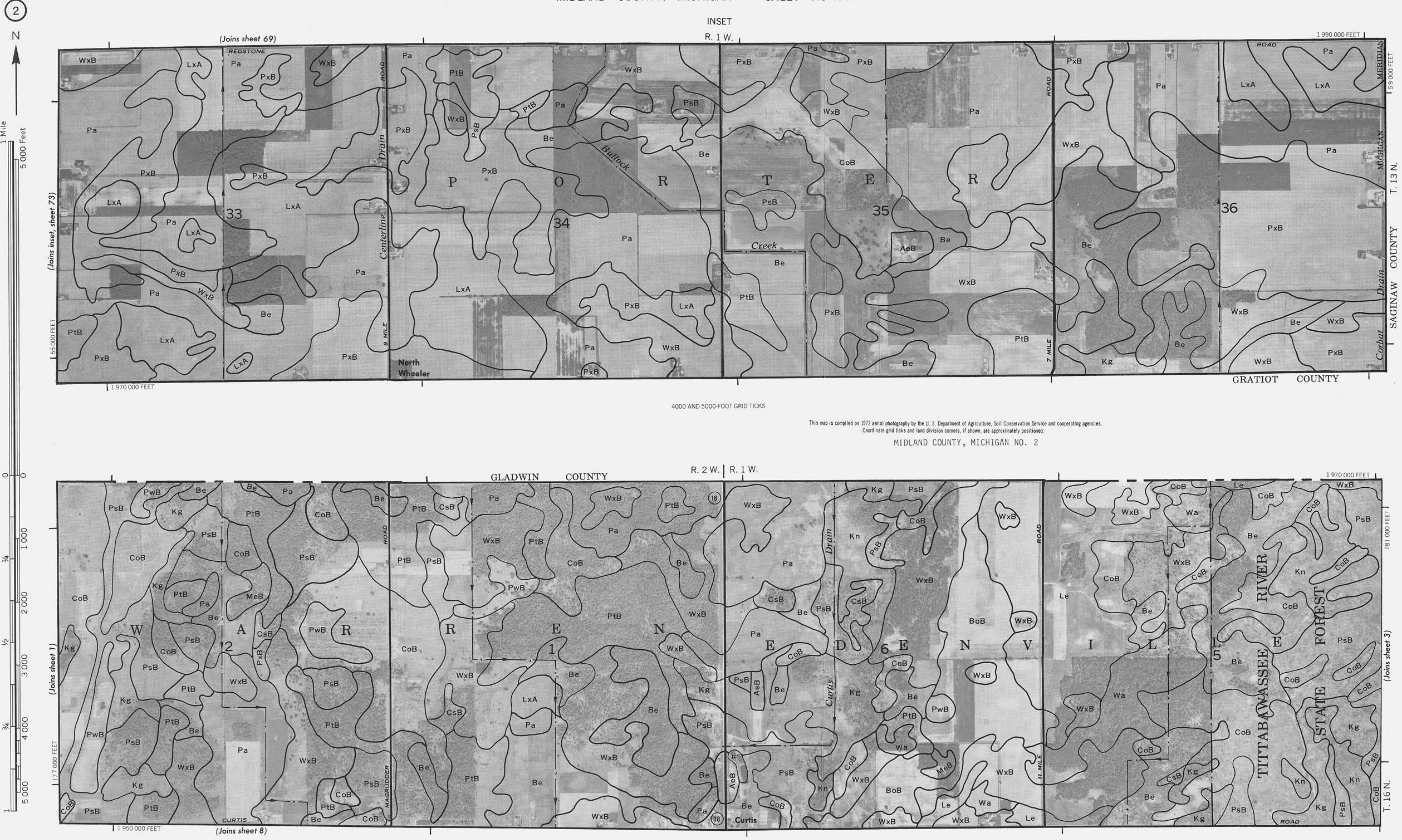
①

MIDLAND COUNTY, MICHIGAN NO. 1

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 930 000 FEET
185 000 FEET
180 000 FEET
1 945 000 FEET
GLADWIN COUNTY
ISABELLA COUNTY
R. 2 W.
T. 16 N.
W A R R E N
6
5
4
3
Howe Drain
Bliss Drain
COLEMAN ROAD
CURTIS ROAD
GENEVA ROAD
ROAD
(Joins sheet 2)
(Joins sheet 7)
1 Mile
5 000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
PsB
Kg
WxB
PtB
Be
Pa
Wa
OaB
PwB
CoB
PxB
Pa

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 2


②
N
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1 000
2 000
3 000
4 000
5 000
INSET
R. 1 W.
(Joins sheet 69)
(Joins inset, sheet 73)
1 990 000 FEET
59 000 FEET
55 000 FEET
1 970 000 FEET
REDSTONE
ROAD
MERIDIAN
MIDLAND
T. 13 N.
SAGINAW COUNTY
GRATIOT COUNTY
Centerline Drain
Bullock
Creek
Corbat Drain
9 MILE
7 MILE
North Wheeler
P O R T E R
33
34
35
36
GLADWIN COUNTY
R. 2 W.
R. 1 W.
1 970 000 FEET
181 000 FEET
177 000 FEET
1 950 000 FEET
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 8)
T. 16 N.
W A R R E N
E D E N V I L L E
2
1
6
5
MAGRUDDER
CURTIS
Curtis
Curtis Drain
11 MILE
18
TITTABAWASSEE RIVER STATE FOREST
ROAD

4000 AND 5000-FOOT GRID TICKS

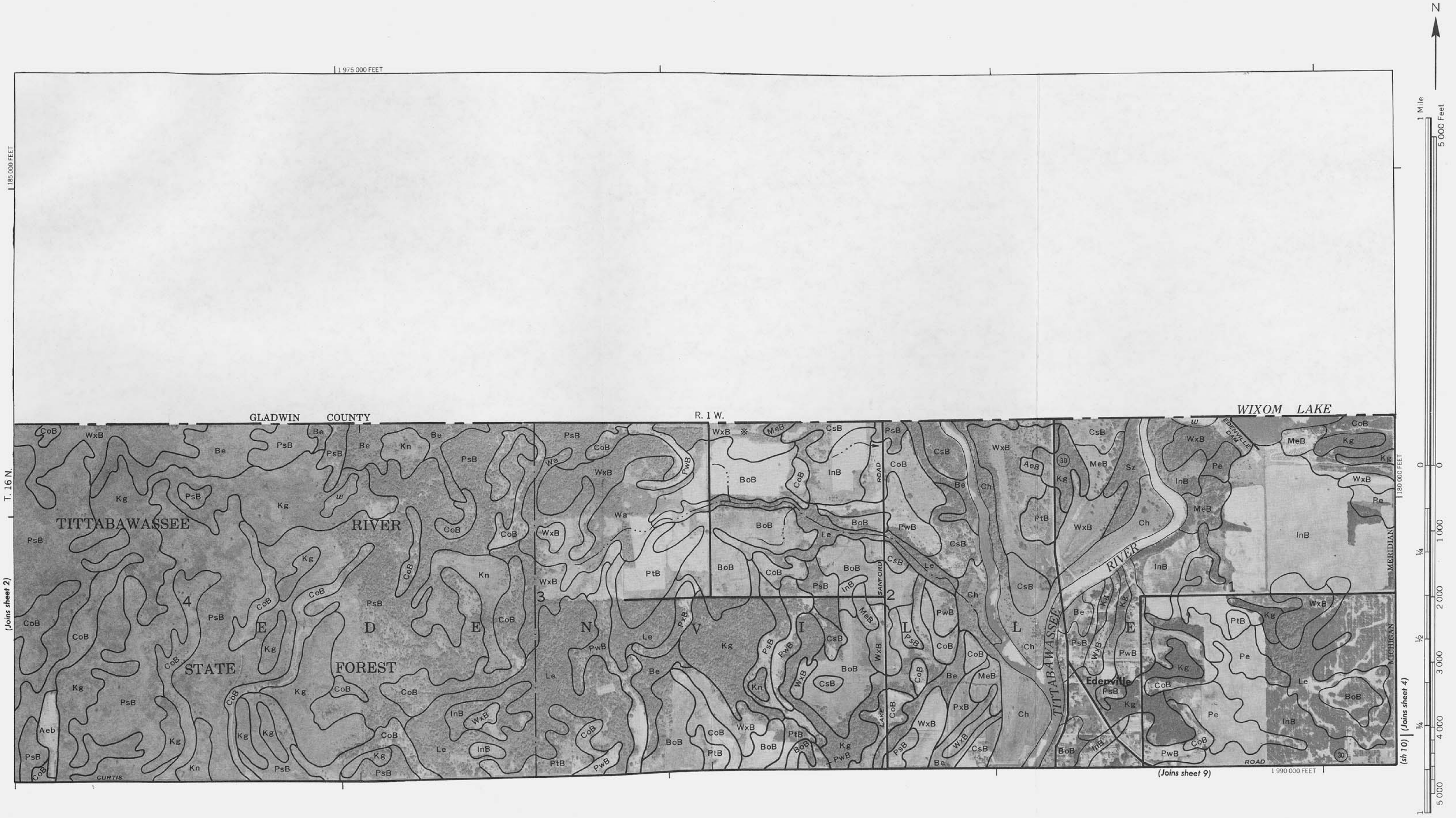
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 2

4000 AND 5000-FOOT GRID TICKS

MIDLAND COUNTY, MICHIGAN NO. 3

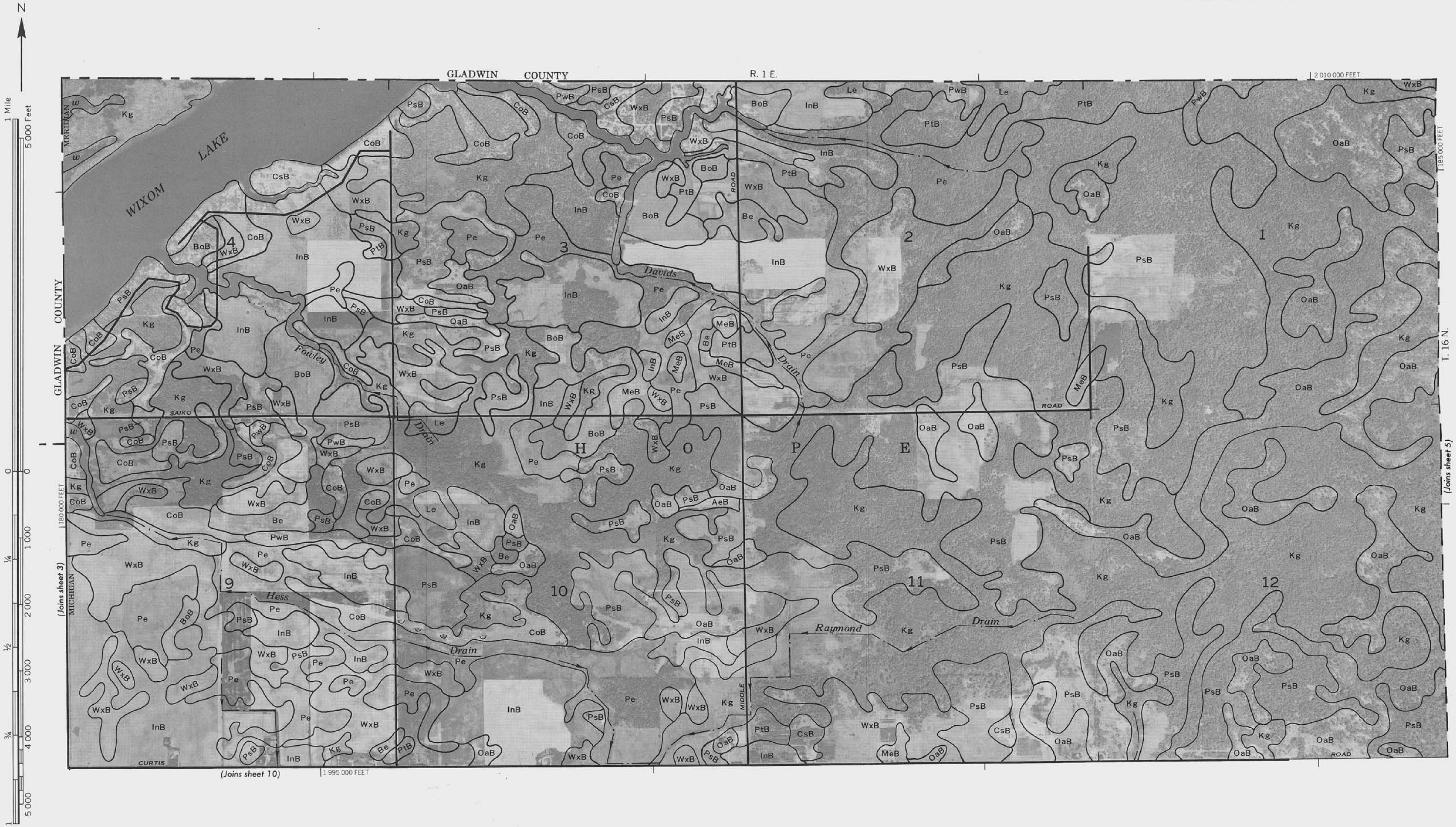
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


3
N
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
1 975 000 FEET
185 000 FEET
180 000 FEET
1 990 000 FEET
T. 16 N.
R. 1 W.
GLADWIN COUNTY
WIXOM LAKE
EDENVILLE DAM
TITTABAWASSEE RIVER
STATE FOREST
EDENVILLE
TITTABAWASSEE
RIVER
Edenville
SANFORD ROAD
LAKE
MERIDIAN
MICHIGAN
ROAD
CURTIS
30
(Joins sheet 2)
(Joins sheet 4)
(sh 10)
(Joins sheet 9)
4
3
2
1
CoB
WxB
Be
PsB
Kn
Kg
Wa
w
PwB
MeB
CsB
BoB
InB
AeB
PtB
Le
Ch
Sz
Pe
PxB
Aeb
CoB
PsB
Kg
Kn
BoB
InB
PtB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 4

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

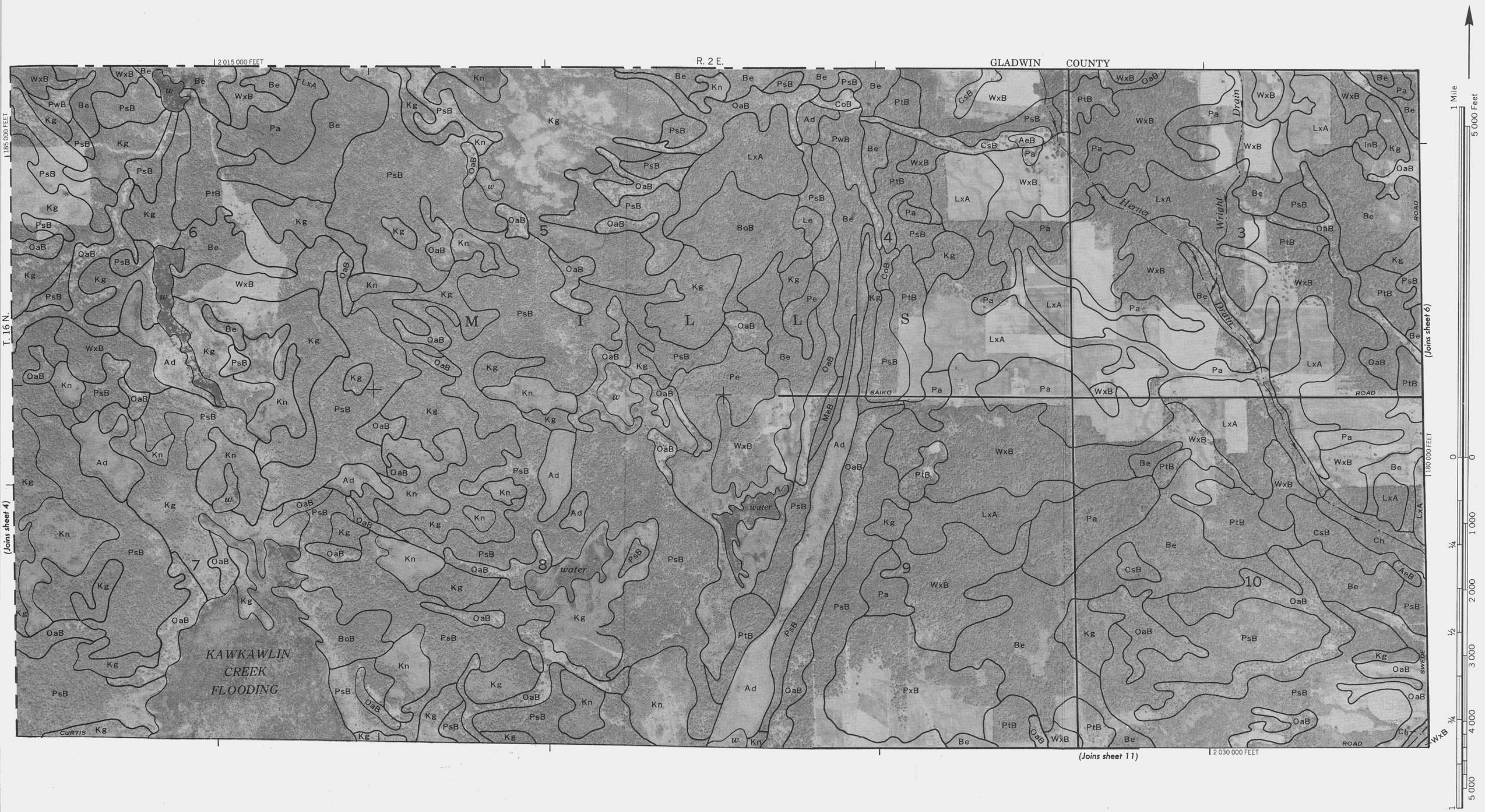
MIDLAND COUNTY, MICHIGAN NO. 4


N
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
GLADWIN COUNTY
R. 1 E.
2 010 000 FEET
185 000 FEET
T. 16 N.
(Joins sheet 5)
WIXOM LAKE
MERIDIAN
GLADWIN COUNTY
MICHIGAN
(Joins sheet 3)
180 000 FEET
1 995 000 FEET
(Joins sheet 10)
CURTIS
ROAD
ROAD
ROAD
MIDDLE
SAIKO
Davids Drain
Fowley Drain
Hess Drain
Raymond Drain
Drain
H O P E
1
2
3
4
9
10
11
12
Kg
PsB
OaB
WxB
CoB
InB
Pe
BoB
PtB
MeB
PwB
CsB
Le
Be
AeB
w

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 5

MIDLAND COUNTY, MICHIGAN NO. 5

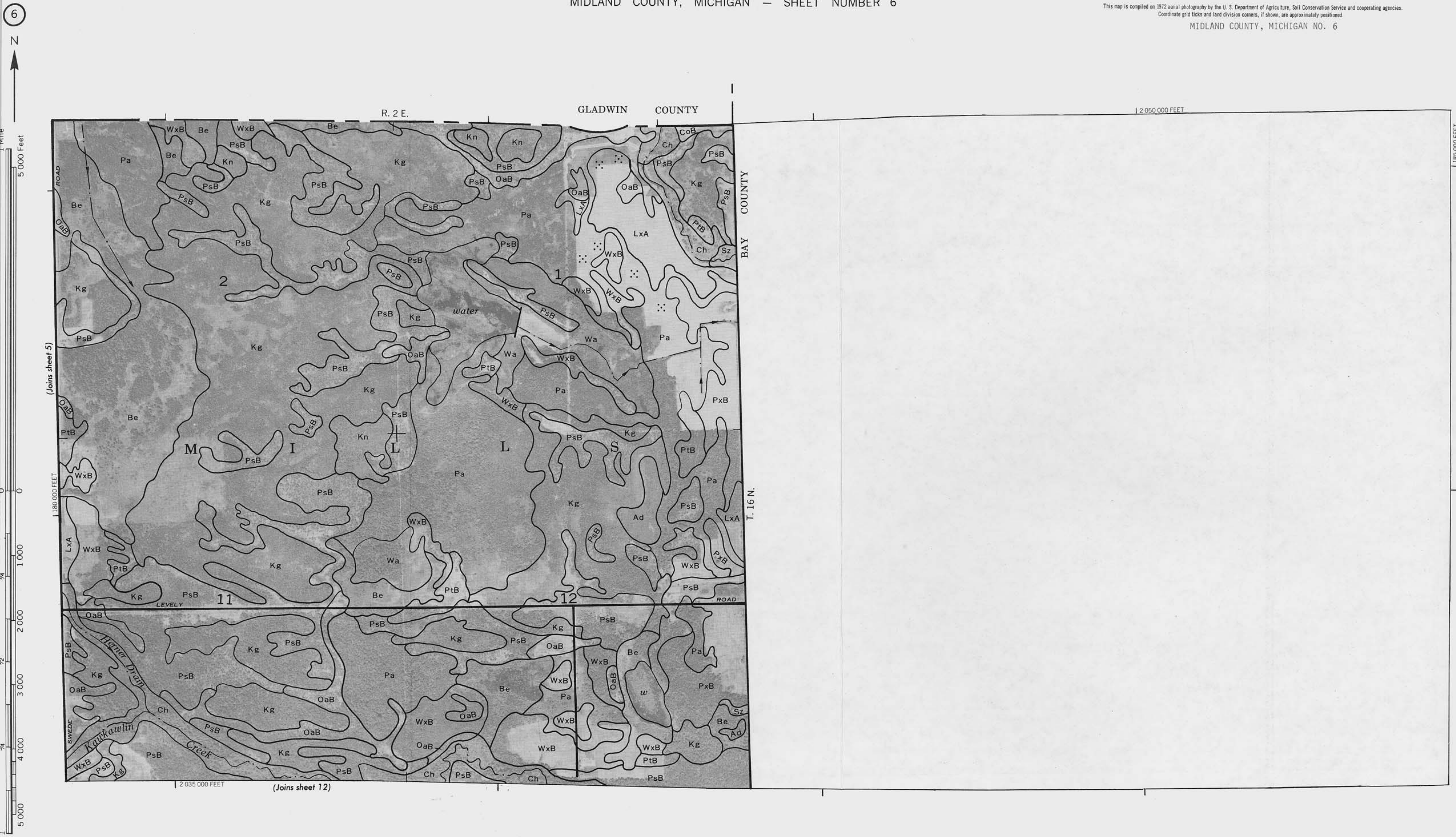
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
2 015 000 FEET
R. 2 E.
GLADWIN COUNTY
185 000 FEET
T. 16 N.
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 11)
180 000 FEET
2 030 000 FEET
M I L L S
KAWKAWLIN CREEK FLOODING
Herner Drain
Wright Drain
SAIKO ROAD
ROAD
SWEDE
CURTIS
3
4
5
6
7
8
9
10
water
w
WxB
Be
PsB
Kg
Pa
PtB
OaB
Kn
Ad
LxA
BoB
PwB
CoB
CsB
AeB
InB
Le
Pe
MeB
PxB
Ch
1 Mile
5 000 Feet
0
¼
½
¾
1000
2000
3000
4000
5 000

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 6

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

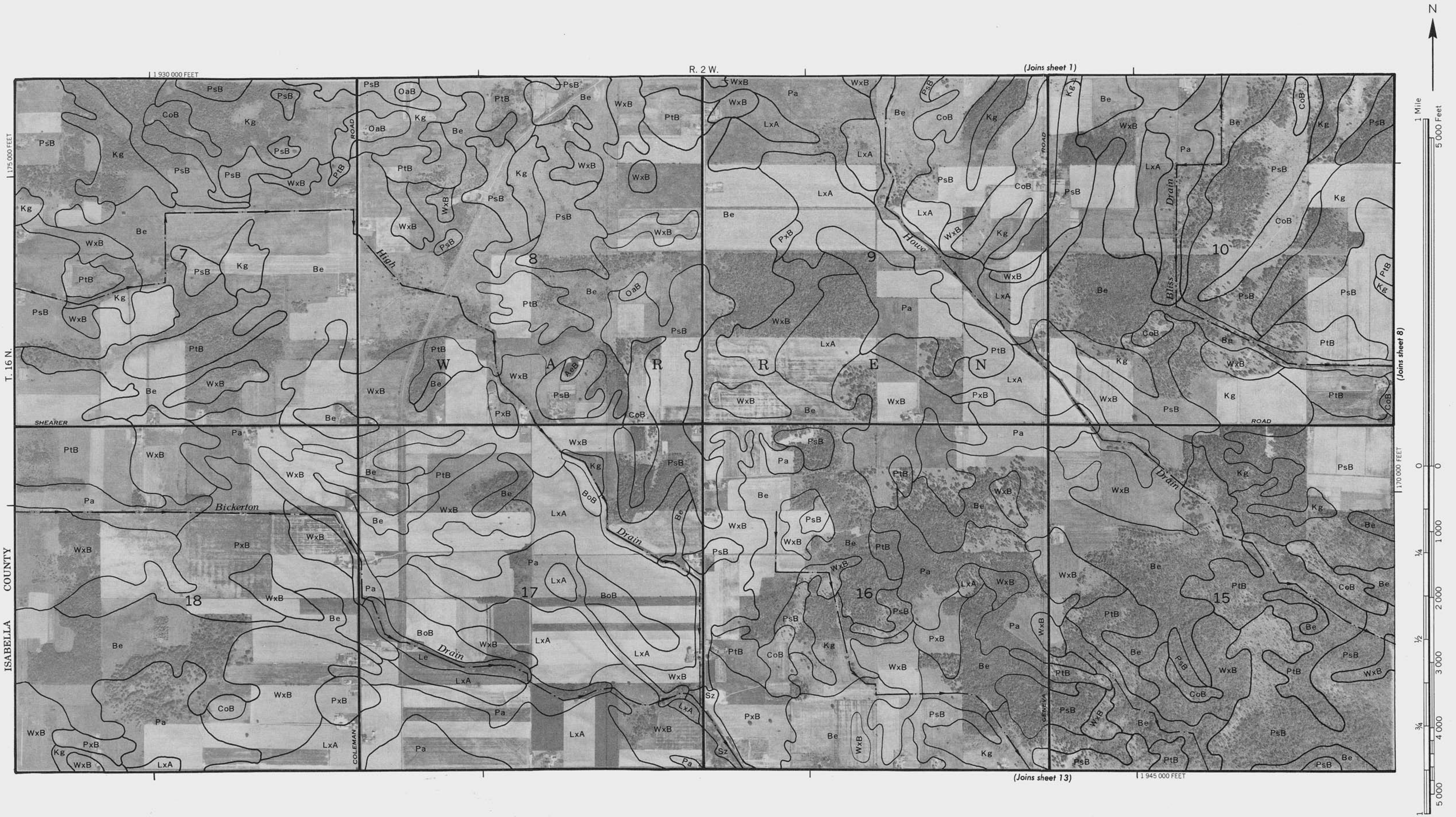
MIDLAND COUNTY, MICHIGAN NO. 6


6
N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
R. 2 E.
GLADWIN
COUNTY
BAY
COUNTY
T. 16 N.
2 050 000 FEET
185 000 FEET
180 000 FEET
2 035 000 FEET
(Joins sheet 5)
(Joins sheet 12)
ROAD
LEVELY
ROAD
SWEDE
Herner Drain
Kawkawlin
Creek
water
w
M
I
L
L
S
1
2
11
12
Pa
Be
WxB
PsB
Kn
Kg
OaB
CoB
Ch
PtB
Sz
LxA
Wa
PxB
Ad

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 7

MIDLAND COUNTY, MICHIGAN NO. 7

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

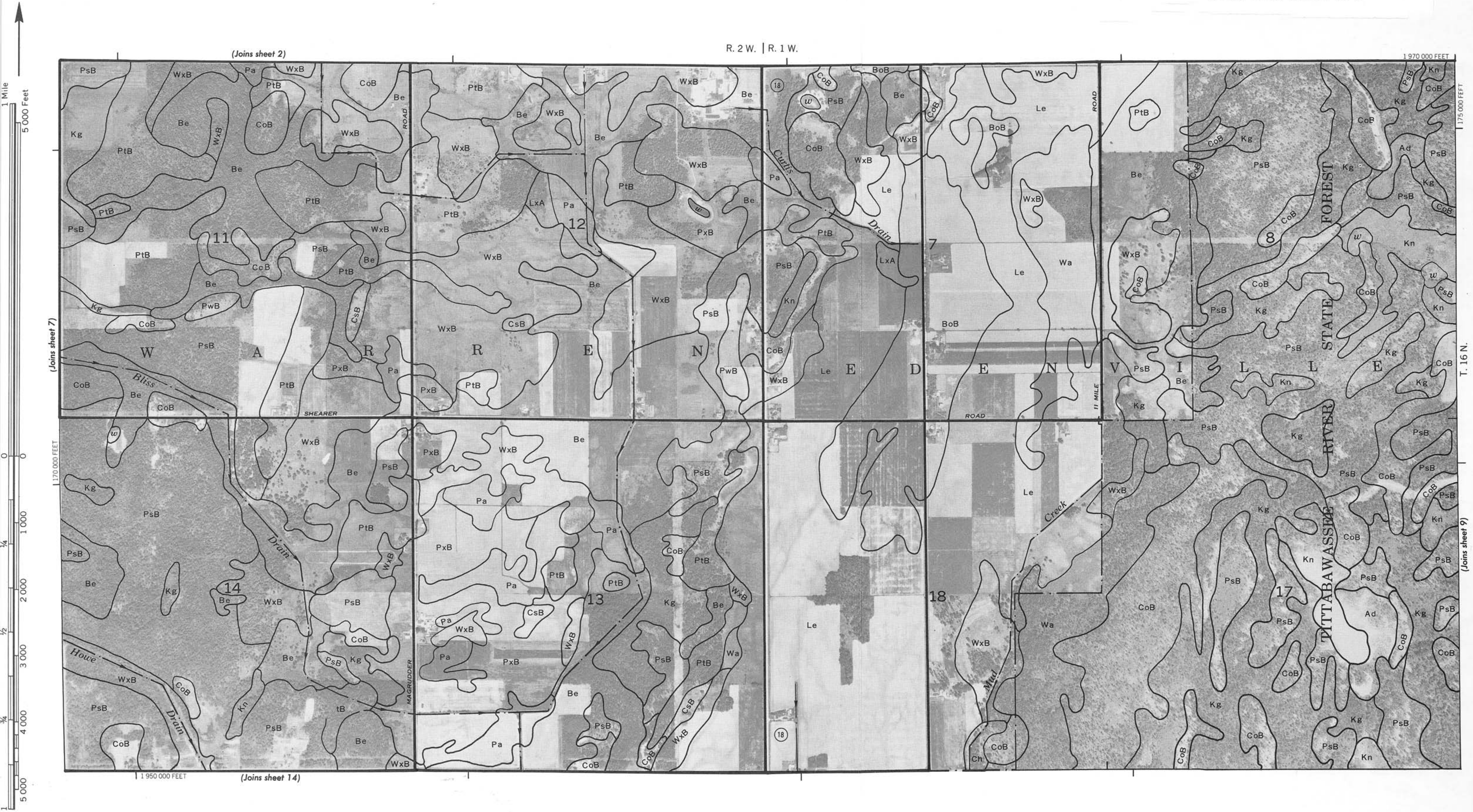


7
N
R. 2 W.
(Joins sheet 1)
(Joins sheet 8)
(Joins sheet 13)
1 930 000 FEET
1 945 000 FEET
175 000 FEET
170 000 FEET
T. 16 N.
ISABELLA COUNTY
W A R R E N
7
8
9
10
15
16
17
18
SHEARER
ROAD
High
Howe
Drain
Bliss
Drain
Bickerton
Drain
Drain
COLEMAN
GENEVA
ROAD
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1 000
2 000
3 000
4 000
5 000

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 8

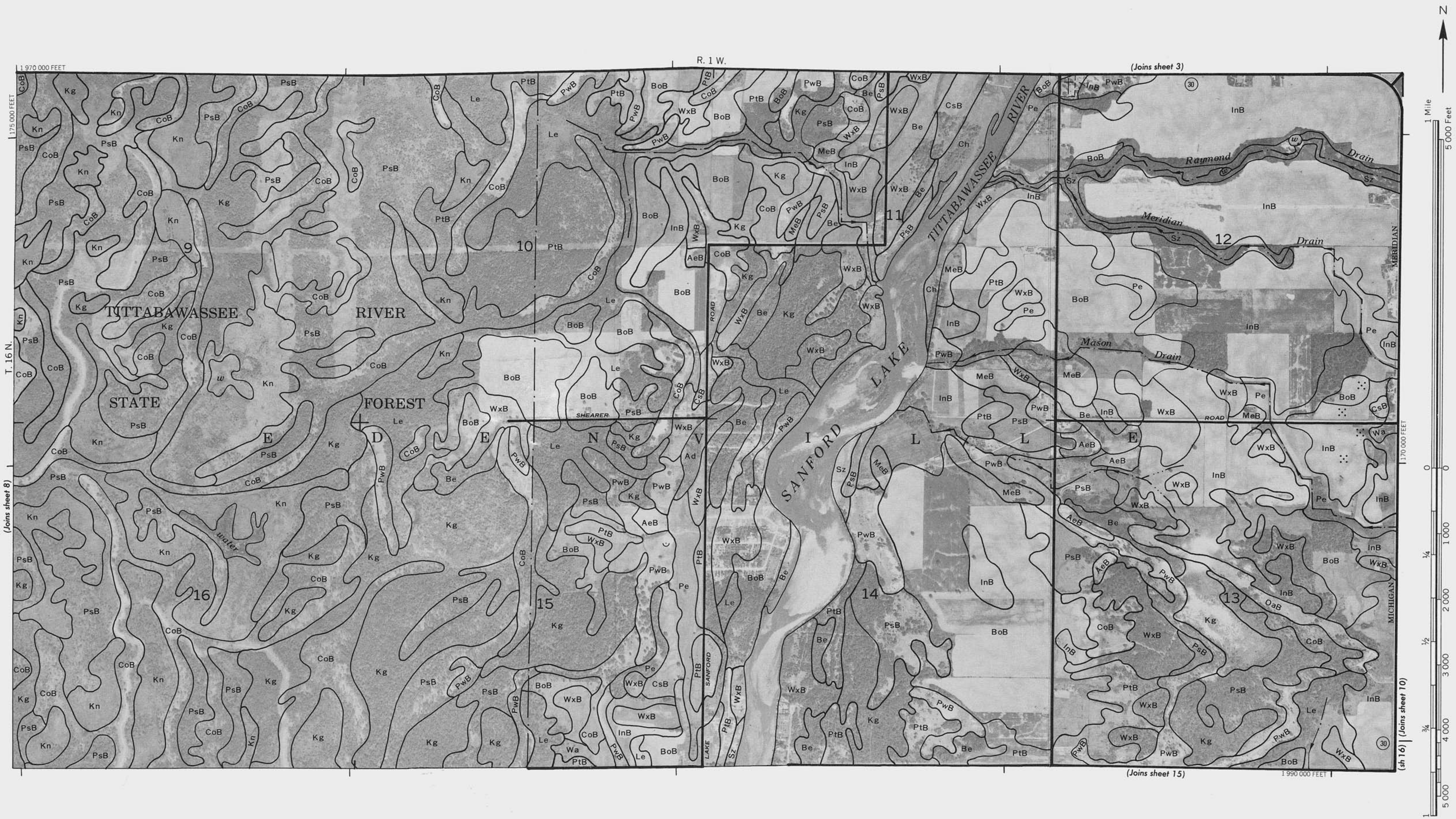
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 8


N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
(Joins sheet 2)
R. 2 W. | R. 1 W.
1 970 000 FEET
175 000 FEET
170 000 FEET
1 950 000 FEET
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 14)
T. 16 N.
W A R R E N
E D E N V I L L E
11
12
7
8
14
13
18
17
18
ROAD
SHEARER
MAGRUDDER
11 MILE
ROAD
Curtis Drain
Bliss
Drain
Howe
Drain
Mud
Creek
PITTASAWASSEE RIVER STATE FOREST
PsB
WxB
Pa
PtB
CoB
Be
Kg
PsB
CcB
PwB
CsB
PxB
LxA
Kn
Le
Wa
BoB
Ad
Ch
w

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 9

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

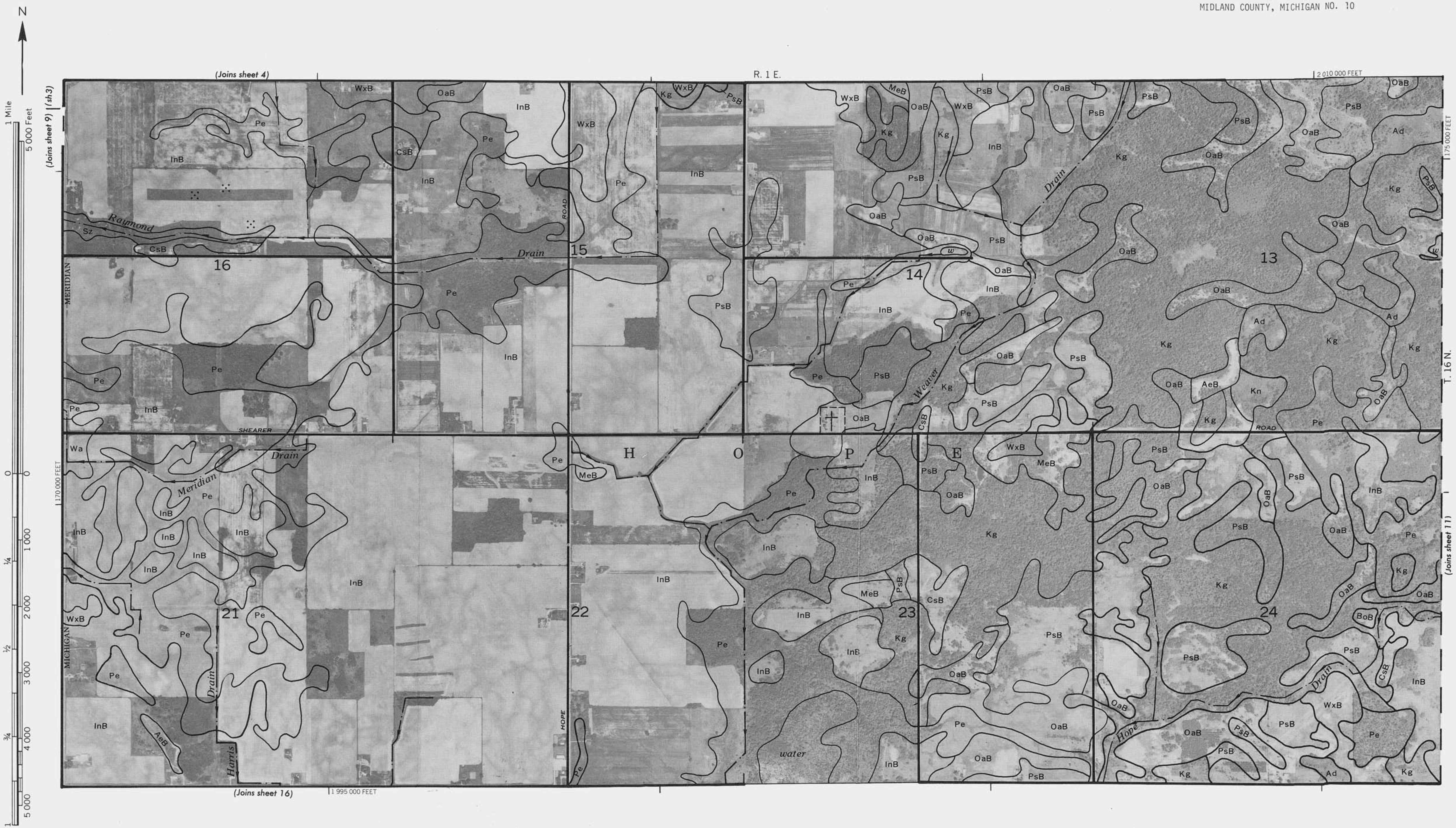

N
R. 1 W.
T. 16 N.
1 970 000 FEET
175 000 FEET
170 000 FEET
1 990 000 FEET
(Joins sheet 3)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 15)
(sh 16)
TITTABAWASSEE RIVER
TITTABAWASSEE RIVER
STATE FOREST
EDEN
VILLE
SANFORD LAKE
Raymond Drain
Meridian Drain
Mason Drain
SHEARER ROAD
ROAD
SANFORD LAKE ROAD
MERIDIAN
MICHIGAN
water
30
9
10
11
12
13
14
15
16
1 Mile
5 000 Feet
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

⑩

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 10

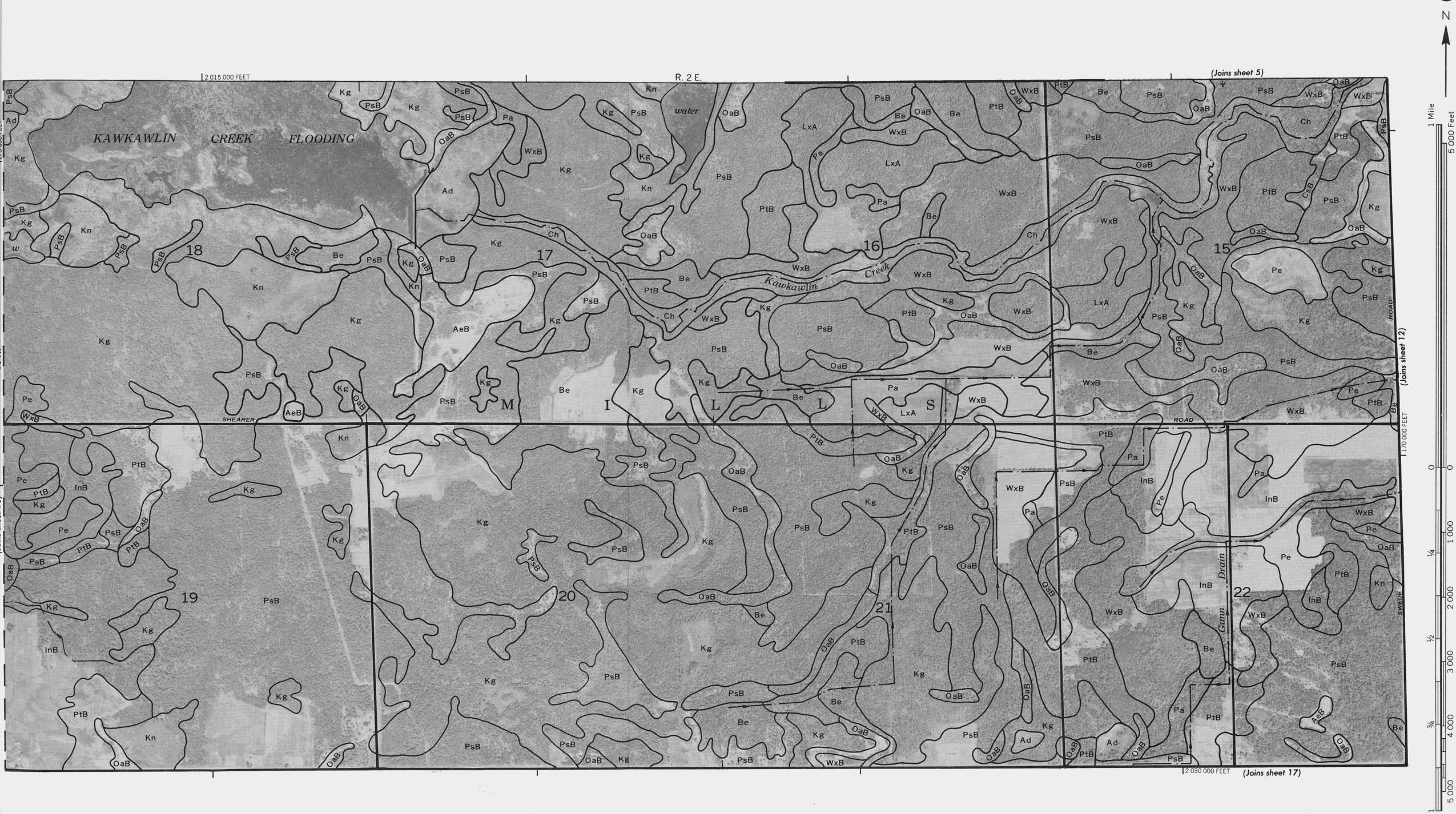
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 10


N
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000
(Joins sheet 4)
R. 1 E.
2 010 000 FEET
175 000 FEET
T. 16 N.
(Joins sheet 11)
(Joins sheet 16)
1 995 000 FEET
170 000 FEET
(Joins sheet 9)
(sh3)
13
14
15
16
21
22
23
24
H O P E
Raymond
Drain
Meridian
Weaver
Harris
Hope
ROAD
SHEARER
MERIDIAN
MICHIGAN
HOPE
water
InB
Pe
OaB
PsB
Kg
WxB
CsB
MeB
Sz
Wa
AeB
Ad
Kn
BoB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 11

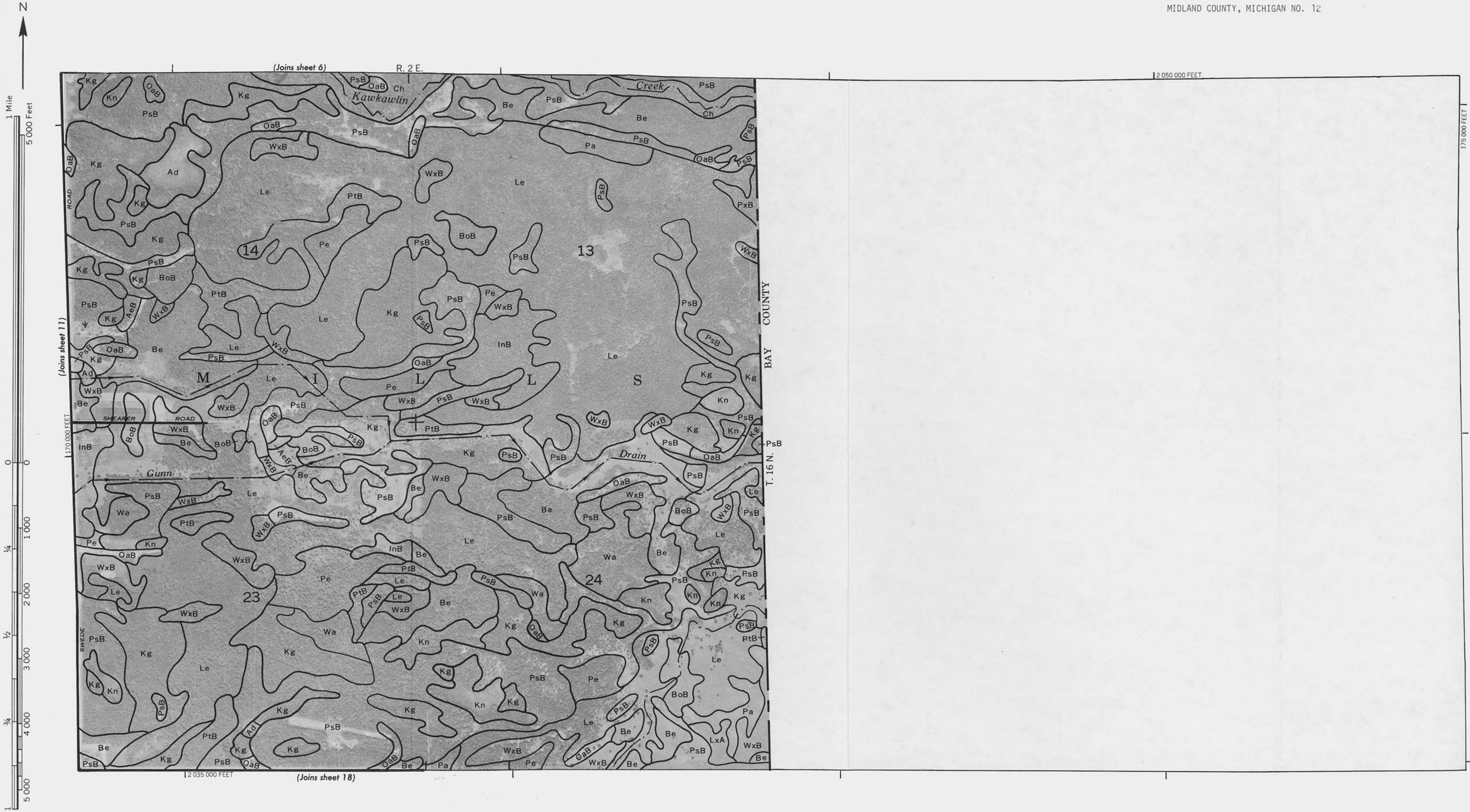
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


11
N
(Joins sheet 5)
(Joins sheet 12)
(Joins sheet 17)
R. 2 E.
2 015 000 FEET
2 030 000 FEET
170 000 FEET
KAWKAWLIN CREEK FLOODING
water
Kawkawlin Creek
Gunn Drain
M I L L S
SHEARER ROAD
SWEDE ROAD
15
16
17
18
19
20
21
22
Ad
AeB
Be
Ch
CsB
InB
Kg
Kn
LxA
OaB
Pa
Pe
PsB
PtB
WxB
w
1 Mile
5 000 Feet
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 12

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 12

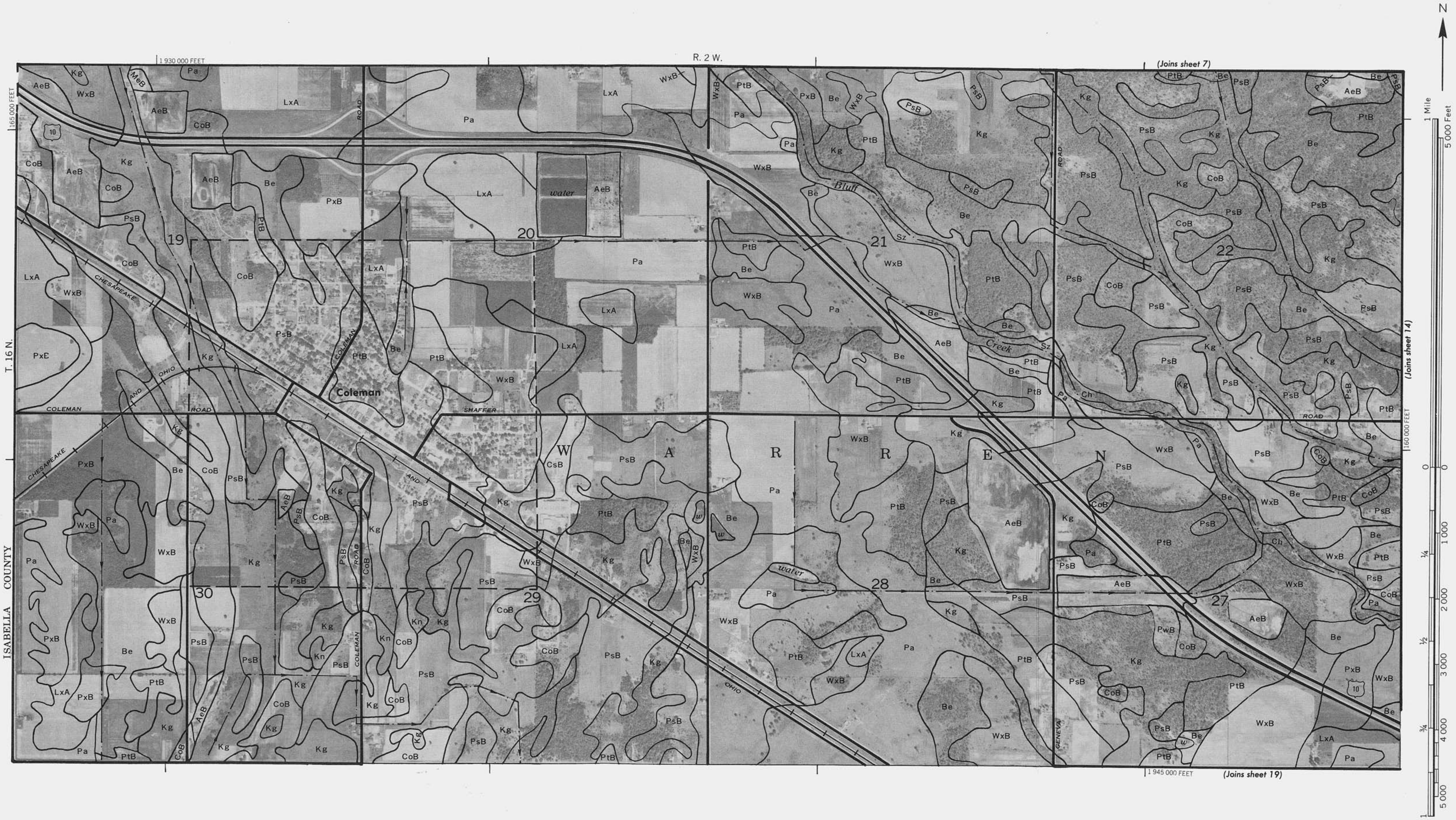

12
N
1 Mile
5 000 Feet
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
1
(Joins sheet 6)
R. 2 E.
2 050 000 FEET
175 000 FEET
(Joins sheet 11)
170 000 FEET
2 035 000 FEET
(Joins sheet 18)
Kawkawlin
Creek
Ch
ROAD
SHEARER ROAD
Gunn
Drain
SWEDE
14
13
23
24
M I L L S
BAY COUNTY
T. 16 N.
Kg
Kn
OaB
PsB
Be
Pa
Le
Ad
WxB
PtB
BoB
Pe
InB
AeB
PxB
Wa
LxA
PsB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 13

MIDLAND COUNTY, MICHIGAN NO. 13

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

⑬

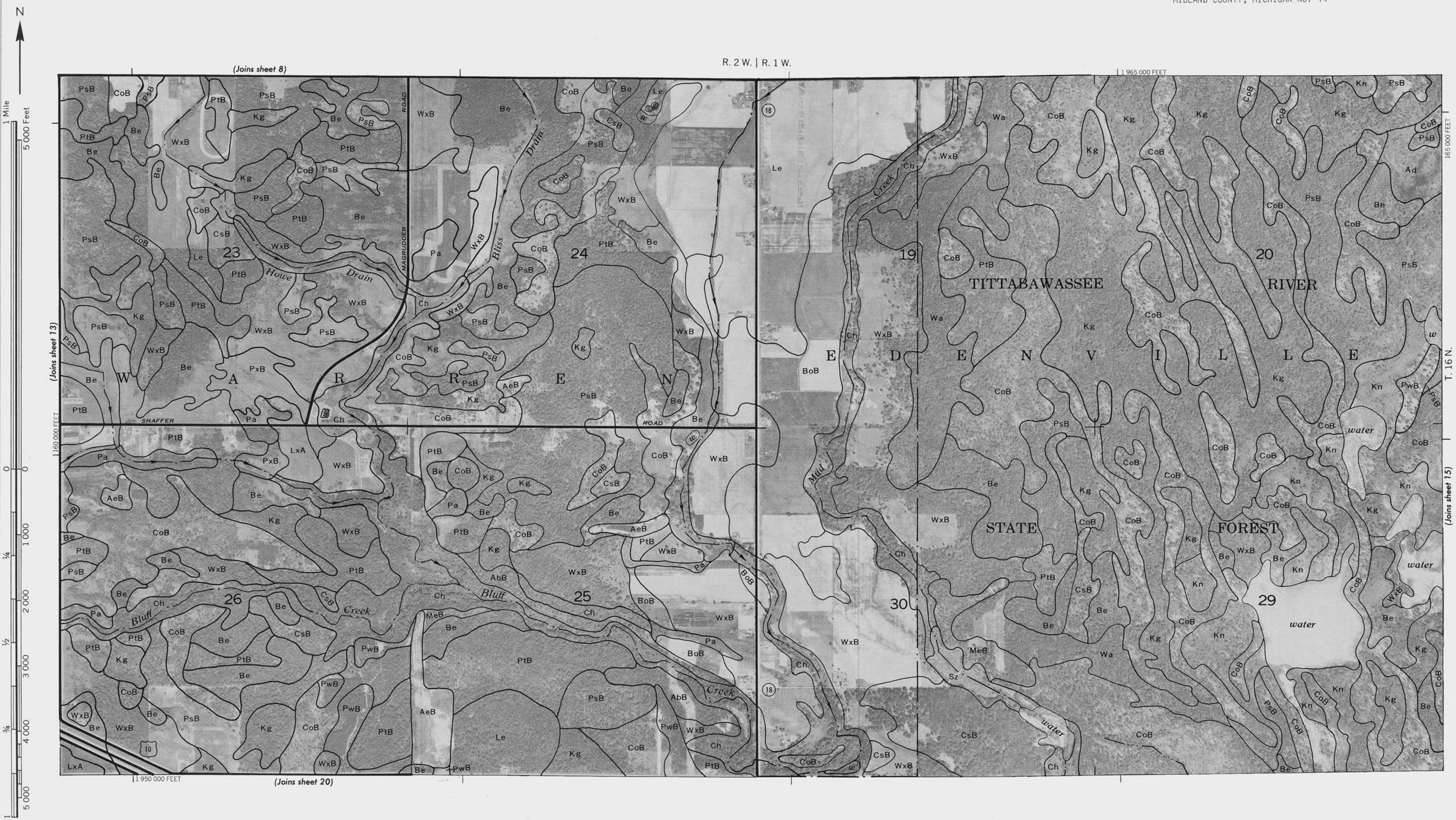

N
1 930 000 FEET
R. 2 W.
(Joins sheet 7)
165 000 FEET
T. 16 N.
ISABELLA COUNTY
(Joins sheet 14)
160 000 FEET
1 945 000 FEET
(Joins sheet 19)
Coleman
W A R R E N
19
20
21
22
27
28
29
30
10
COLEMAN ROAD
SHAFFER
CHESAPEAKE AND OHIO
GENEVA
ROAD
Bluff Creek
water
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
1000
2000
3000
4000
5000
AeB
WxB
Kg
Pa
LxA
CoB
PsB
PtB
Be
PxB
PxC
MeB
Sz
Ch
CsB
Kn
PwB

⑭

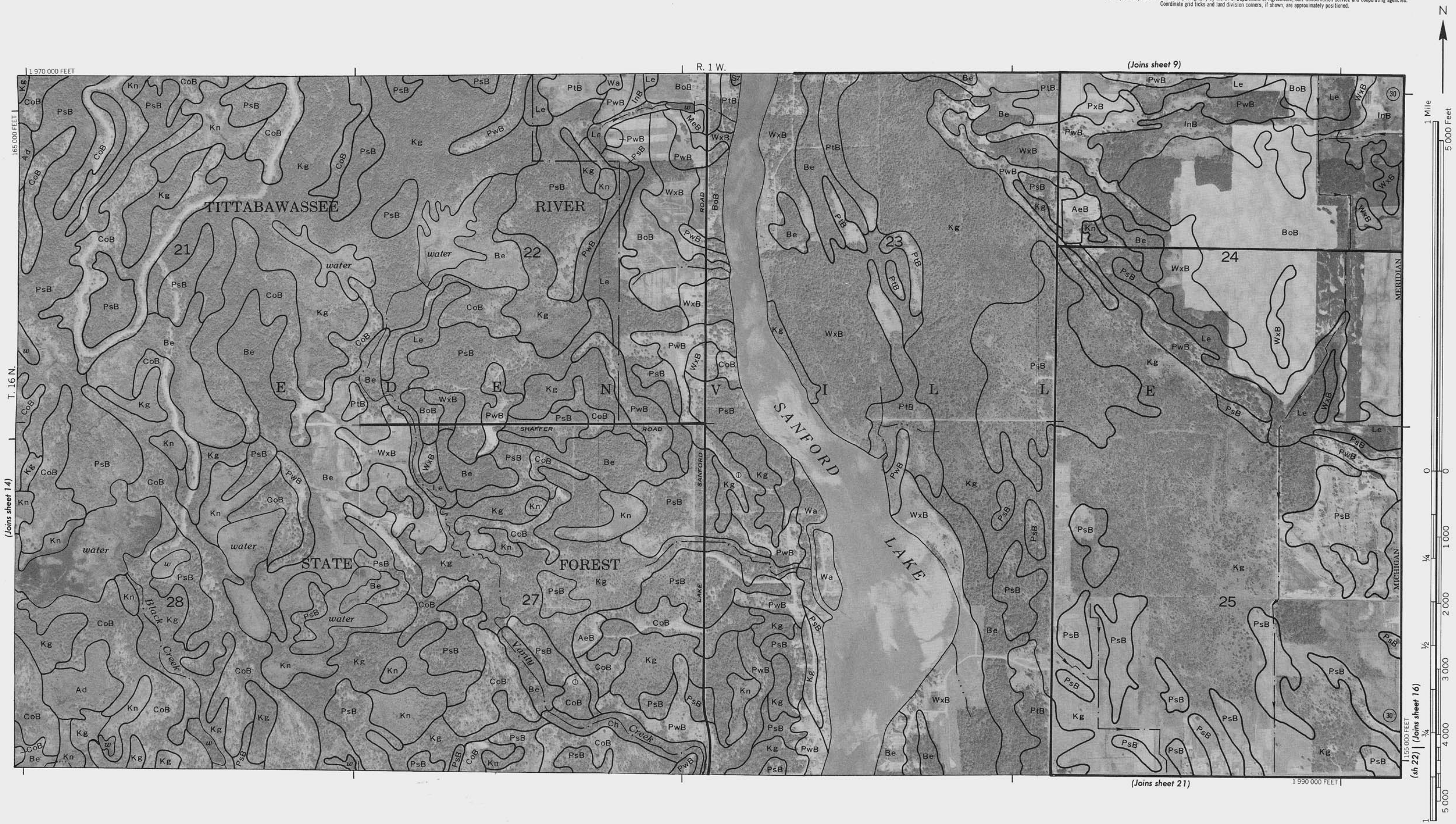
MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 14

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 14


N
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5 000
(Joins sheet 8)
R. 2 W. | R. 1 W.
1 965 000 FEET
165 000 FEET
(Joins sheet 13)
(Joins sheet 15)
160 000 FEET
T. 16 N.
1 950 000 FEET
(Joins sheet 20)
23
24
19
20
26
25
30
29
W A R R E N
E D E N V I L L E
TITTABAWASSEE RIVER
STATE FOREST
MAGRUDDER ROAD
SHAFFER ROAD
Howe Drain
Bliss Drain
Mud Creek
Bluff Creek
Creek
water
w
18
10
PsB
CoB
Be
PtB
Kg
WxB
CsB
Le
Pa
PxB
LxA
AeB
Ch
BoB
AbB
MeB
PwB
Wa
Kn
Ad
Sz

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

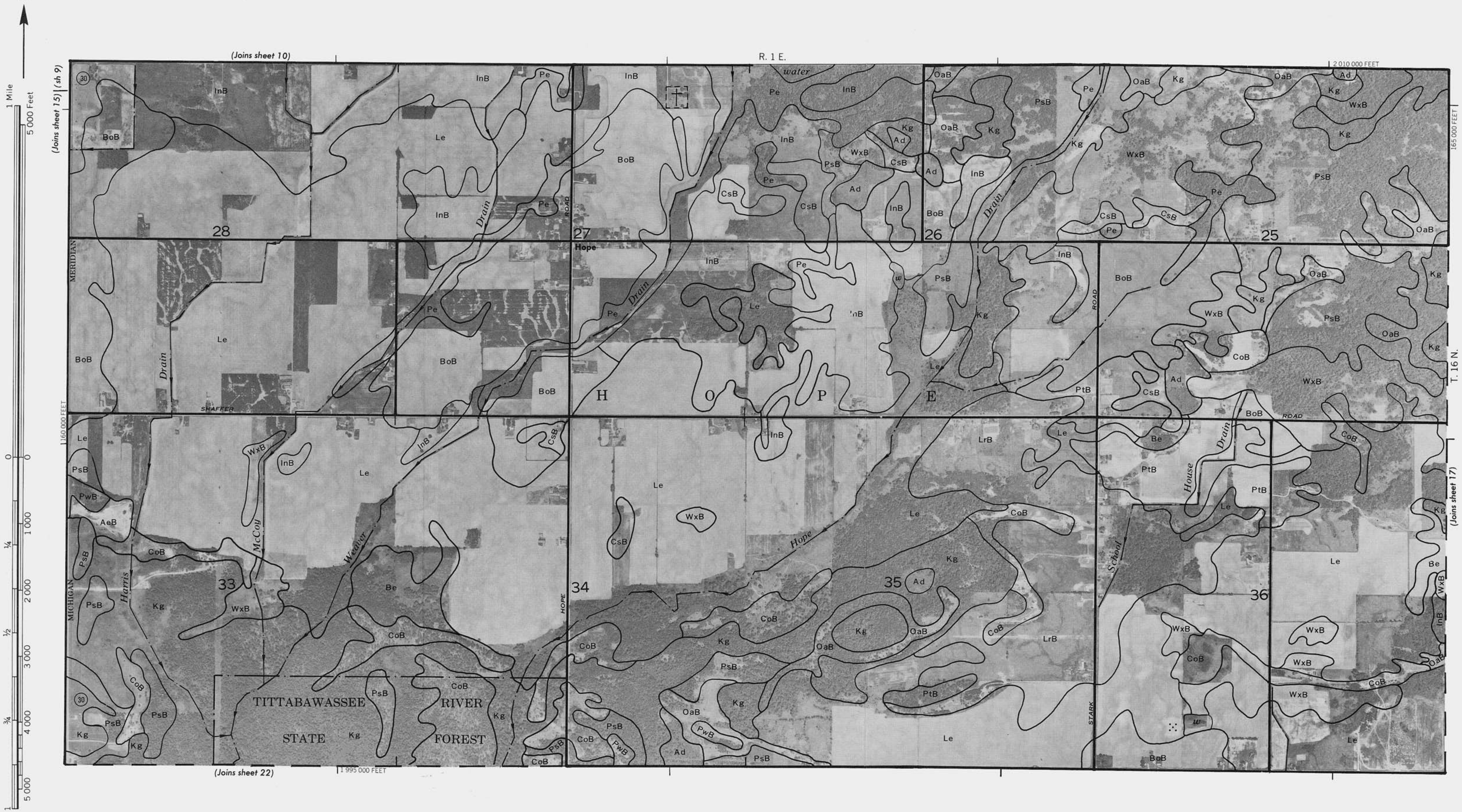

N
(Joins sheet 9)
R. 1 W.
1 970 000 FEET
165 000 FEET
T. 16 N.
(Joins sheet 14)
(Joins sheet 21)
(sh 22) | (Joins sheet 16)
155 000 FEET
1 990 000 FEET
TITTABAWASSEE
RIVER
E D E N V I L L E
STATE
FOREST
SANFORD
LAKE
SHAFFER
ROAD
SANFORD
LAKE
ROAD
MERIDIAN
MICHIGAN
Black
Creek
Vanity
Ch
Creek
water
w
21
22
23
24
25
27
28
30
CoB
PsB
Kg
Kn
Be
Le
PwB
WxB
PtB
BoB
Wa
Ad
AeB
AeB
InB
PxB
MeB
Sz
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
1000
2000
3000
4000
5 000

(16)

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 16

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

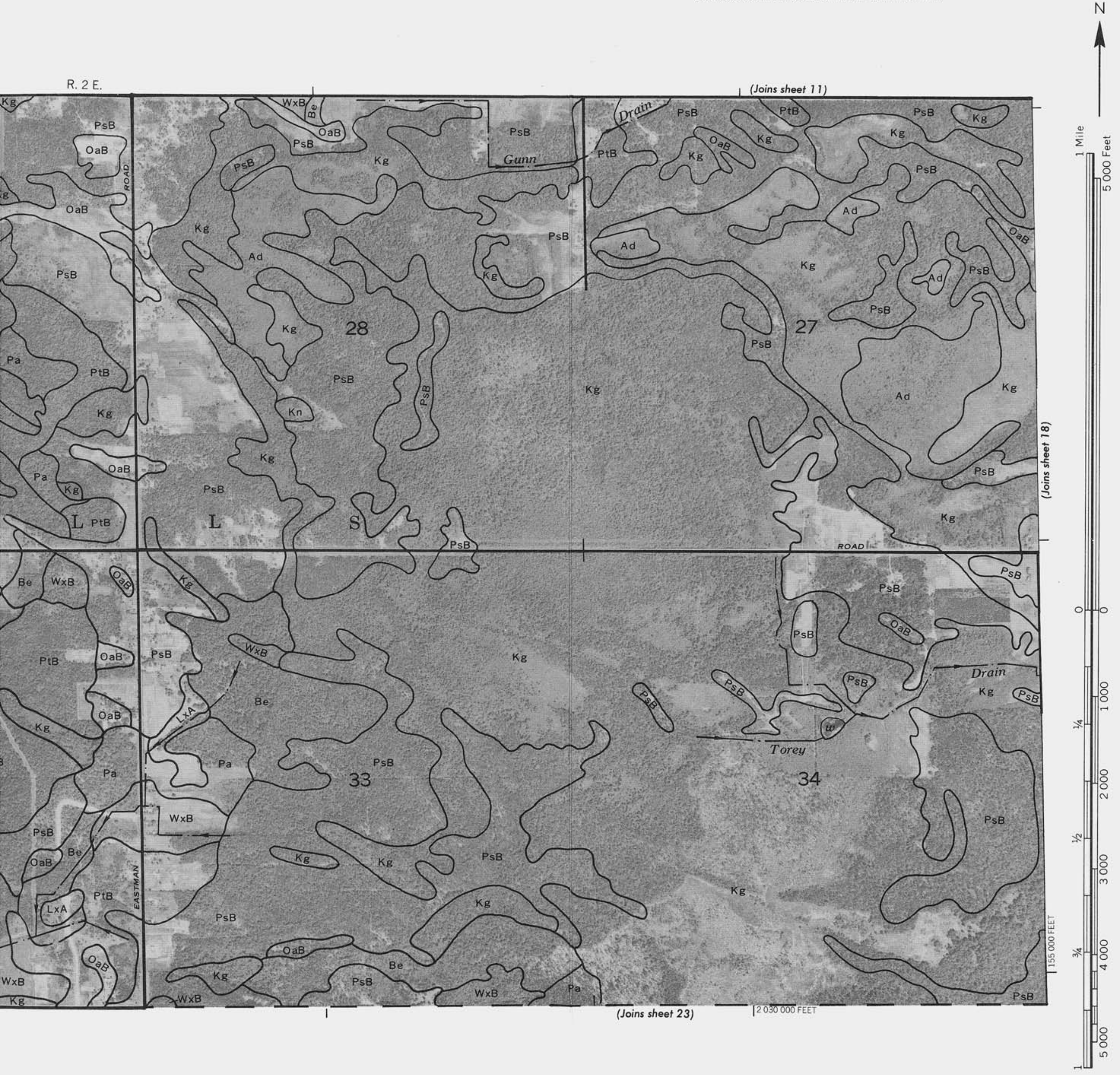
MIDLAND COUNTY, MICHIGAN NO. 16

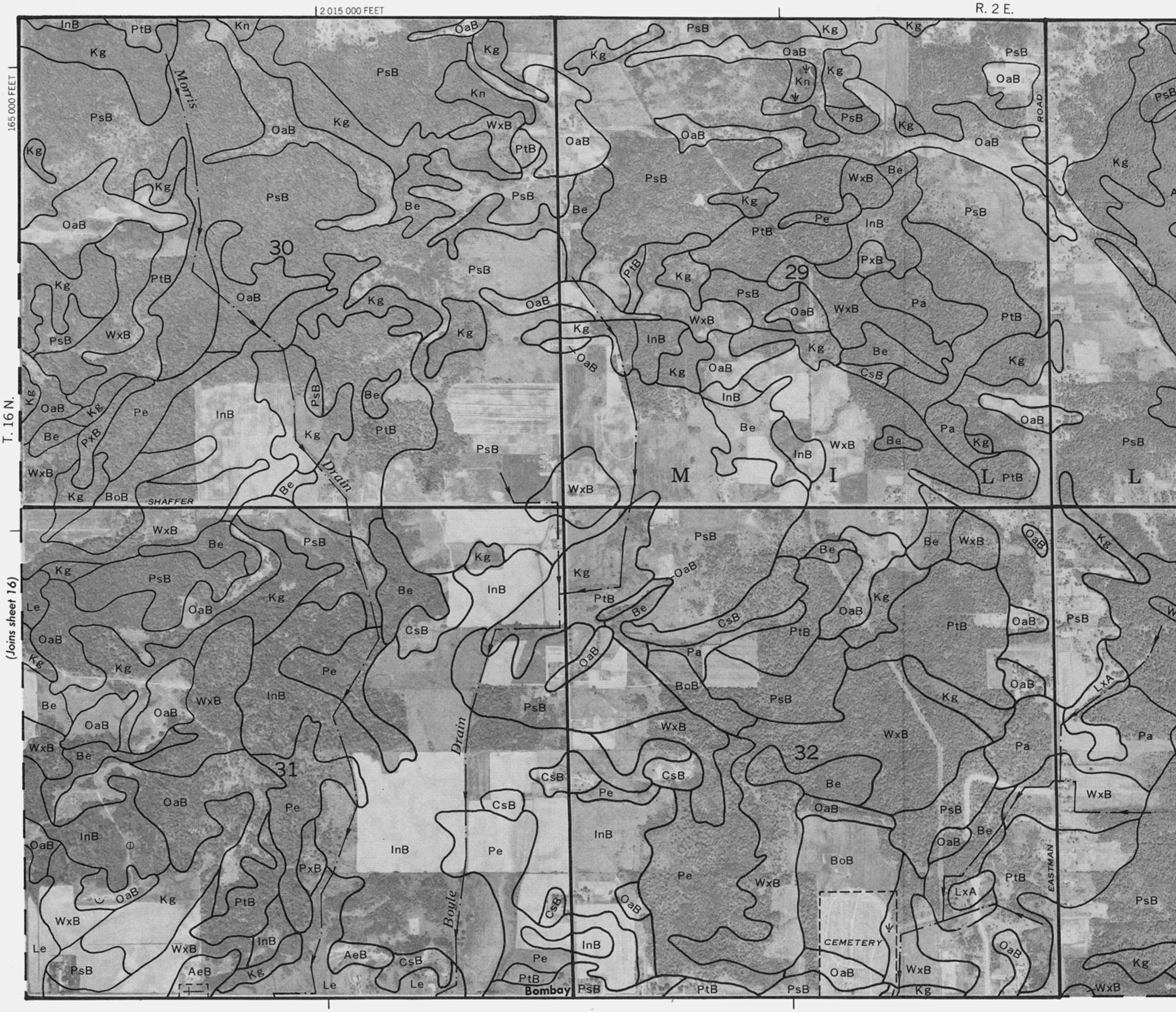

N
1 Mile
5 000 Feet
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
1
(Joins sheet 10)
R. 1 E.
2 010 000 FEET
(Joins sheet 15) | (sh 9)
165 000 FEET
160 000 FEET
T. 16 N.
(Joins sheet 17)
(Joins sheet 22)
1 995 000 FEET
30
28
27
26
25
33
34
35
36
Hope
H O P E
MERIDIAN
MICHIGAN
SHAFFER
ROAD
HOPE
STARK
Drain
Harris
McCoy
Weaver
Hope
School
House
water
w
TITTABAWASSEE RIVER STATE FOREST
InB
BoB
Le
Pe
PsB
OaB
Kg
Ad
WxB
CsB
CoB
LrB
PtB
Be
PwB
AeB

COUNTY, MICHIGAN — SHEET NUMBER 17

MIDLAND COUNTY, MICHIGAN NO. 17

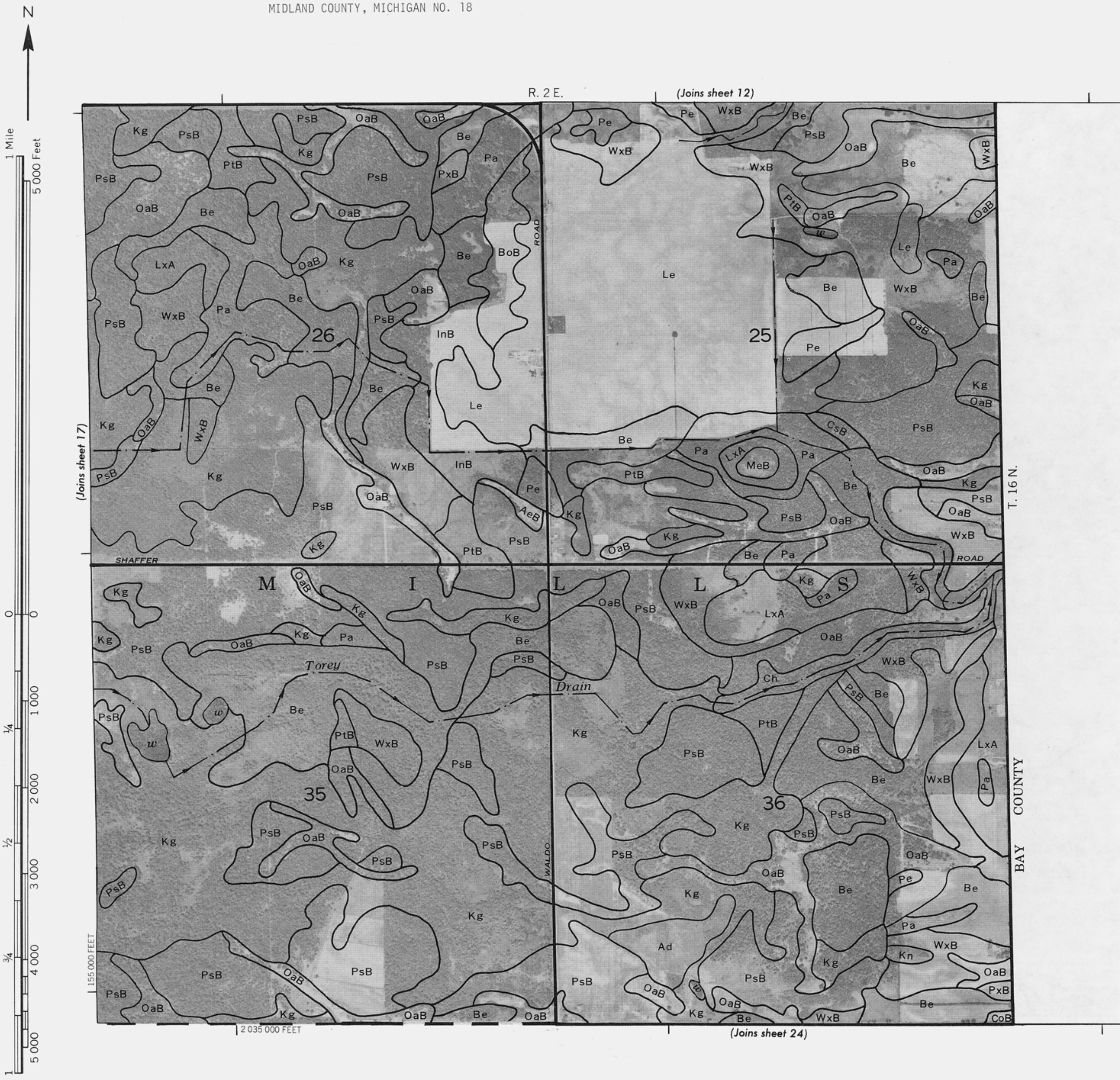
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

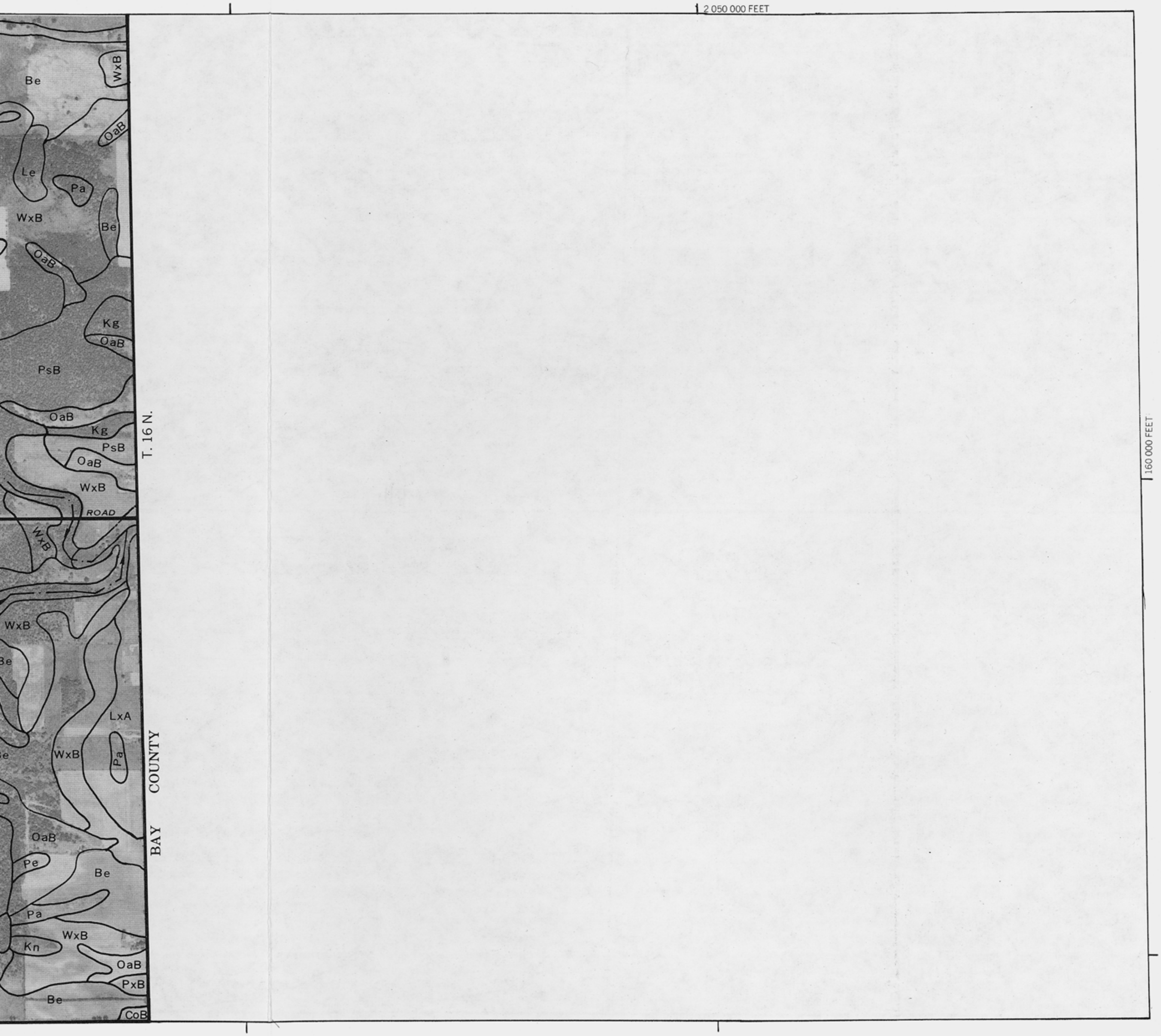

N
R. 2 E.
(Joins sheet 11)
(Joins sheet 18)
(Joins sheet 23)
28
27
33
34
L
L
S
ROAD
ROAD
EASTMAN
Gunn
Drain
Drain
Torey
Kg
PsB
OaB
PtB
Pa
Kn
Ad
WxB
Be
LxA
w
155 000 FEET
2 030 000 FEET
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1


2 015 000 FEET
R. 2 E.
165 000 FEET
T. 16 N.
(Joins sheet 16)
30
29
31
32
M
I
L
L
Morris
Drain
Drain
Boyle
SHAFFER
ROAD
EASTMAN
Bombay
CEMETERY
InB
PtB
Kn
Kg
PsB
OaB
WxB
Be
Pe
PxB
CsB
BoB
Pa
LxA
Le
AeB
Kg
PsB
OaB
InB
WxB
PtB
Be
Pe
CsB
BoB
Pa
LxA

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 18

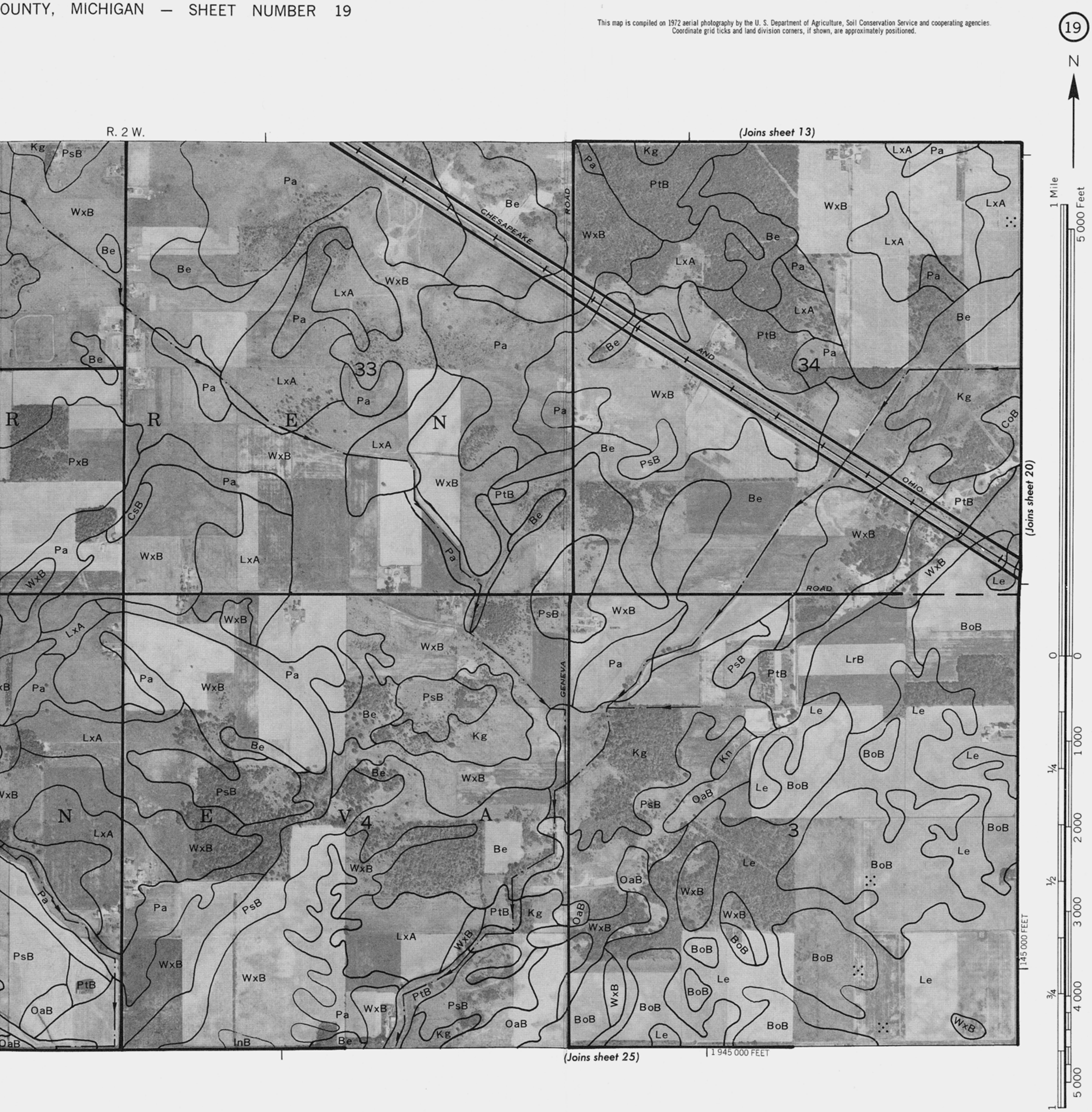

N
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
R. 2 E.
(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 24)
T. 16 N.
BAY COUNTY
26
25
35
36
M I L L S
Torey
Drain
SHAFFER
ROAD
ROAD
WALDO
155 000 FEET
2 035 000 FEET
Kg
PsB
OaB
Be
Pa
PtB
PxB
LxA
WxB
BoB
InB
Le
Pe
AeB
CsB
MeB
Ch
Ad
Kn
CoB
w

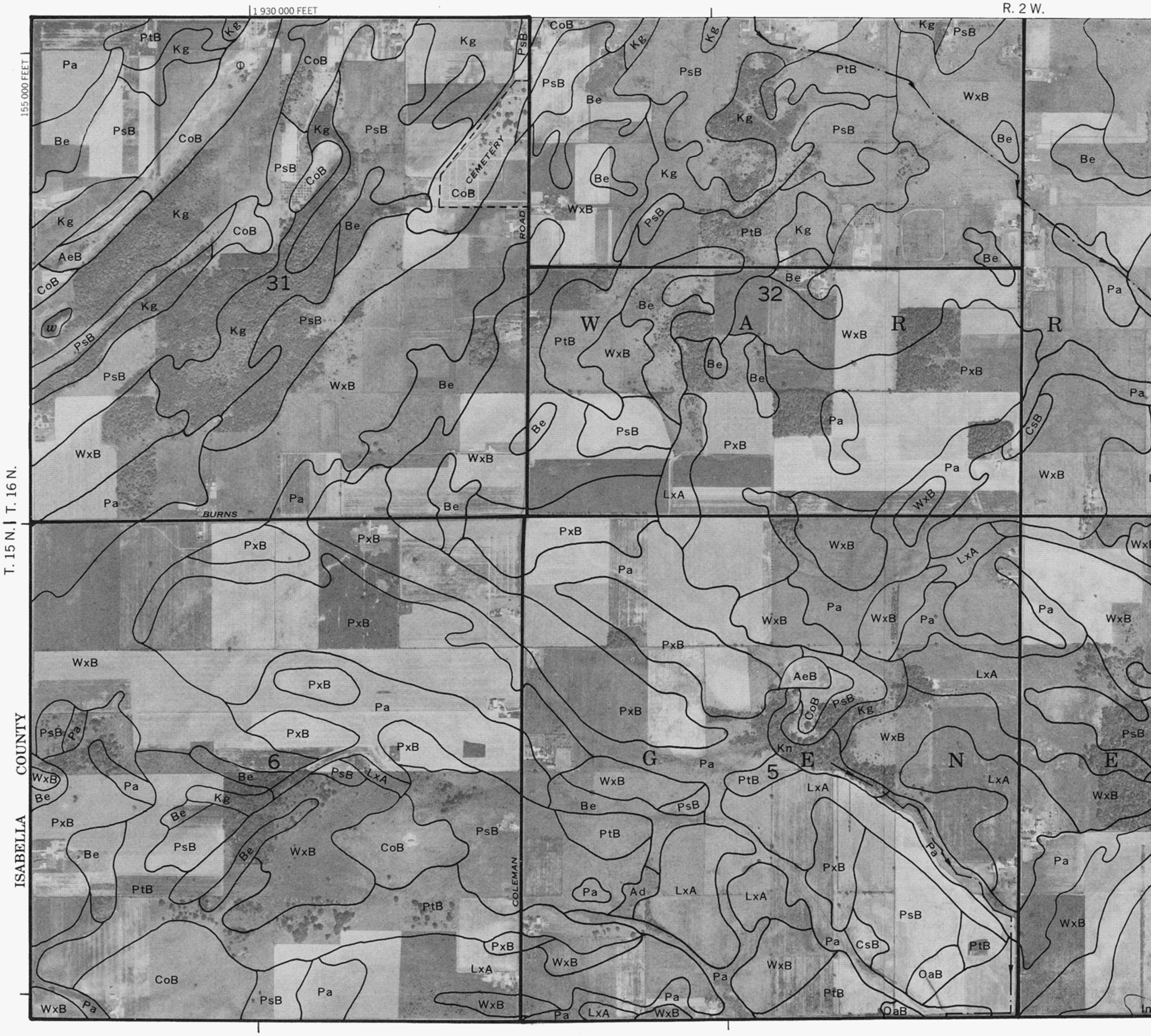

2 050 000 FEET
160 000 FEET
T. 16 N.
BAY COUNTY
ROAD
Be
WxB
OaB
Le
Pa
WxB
Be
OaB
Kg
OaB
PsB
OaB
Kg
PsB
OaB
WxB
WxB
WxB
Be
LxA
WxB
Pa
OaB
Pe
Be
Pa
WxB
Kn
OaB
PxB
Be
CoB

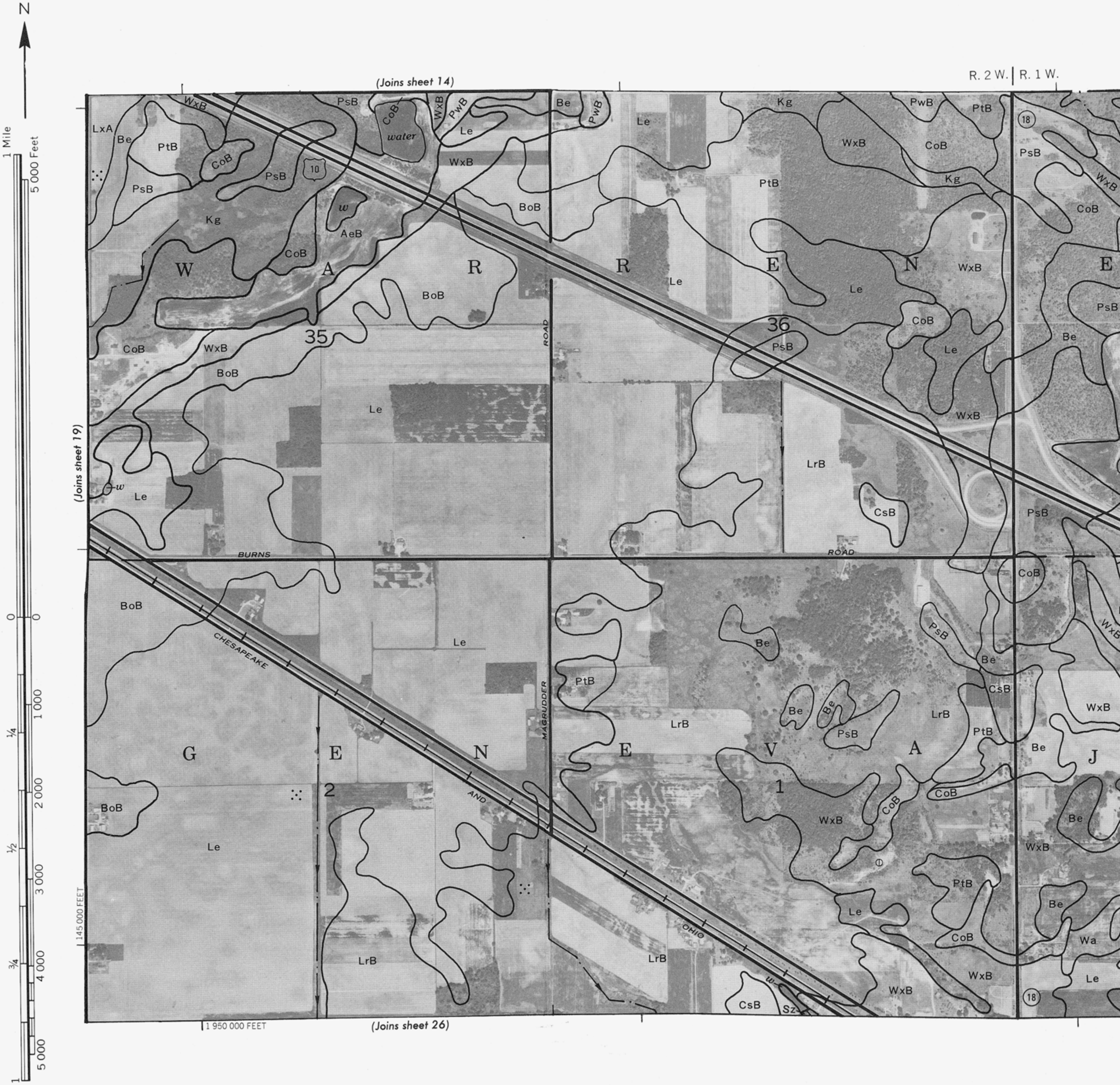
OUNTY, MICHIGAN — SHEET NUMBER 19

MIDLAND COUNTY, MICHIGAN NO. 19

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

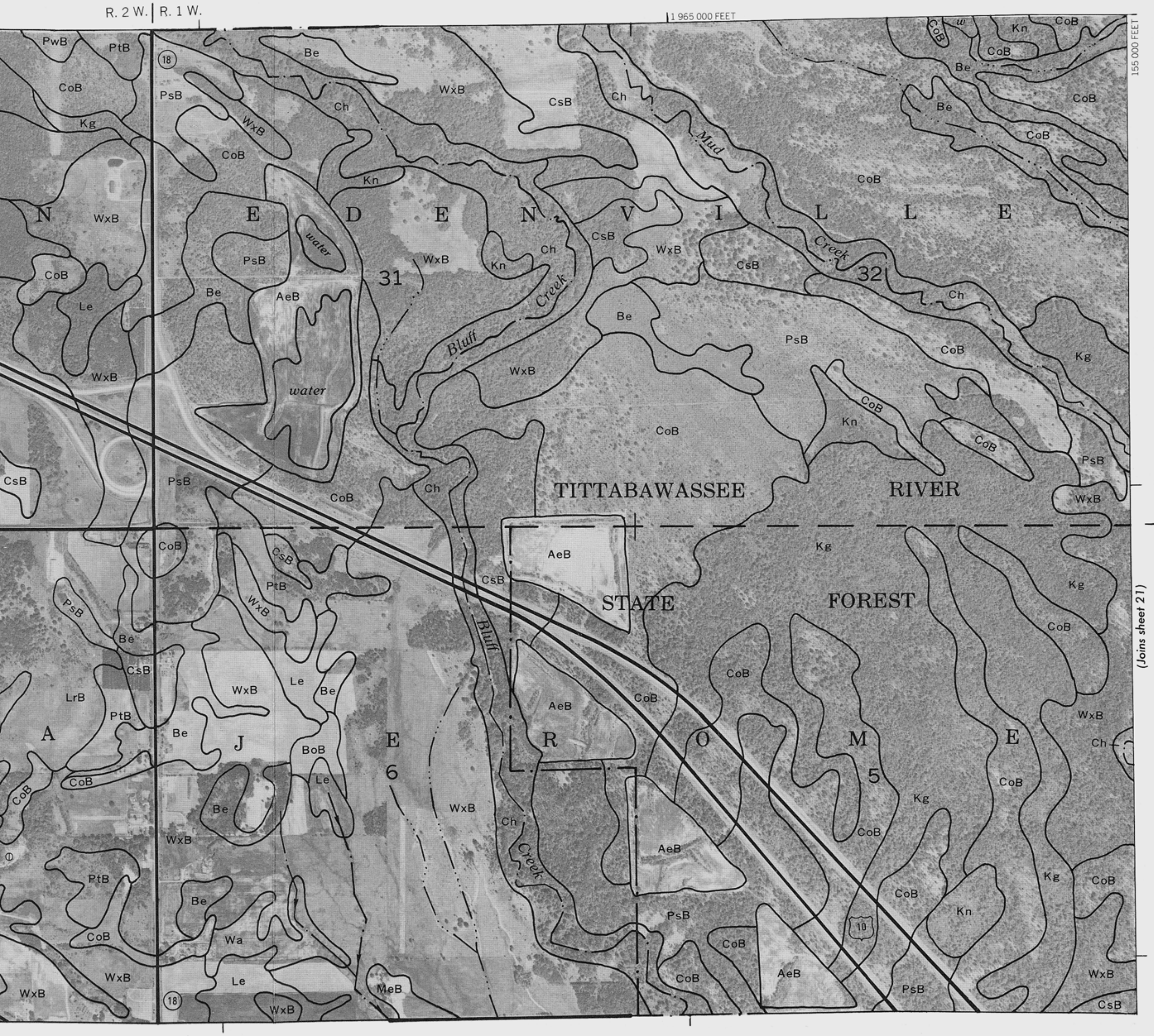

19
N
R. 2 W.
(Joins sheet 13)
(Joins sheet 20)
(Joins sheet 25)
CHESAPEAKE AND OHIO
ROAD
GENEVA ROAD
33
34
4
3
R R E N
N E V A
1 945 000 FEET
145 000 FEET
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
Kg
PsB
Pa
WxB
Be
LxA
PtB
PxB
CsB
CoB
Le
BoB
LrB
Kn
OaB
InB


1 930 000 FEET
155 000 FEET
R. 2 W.
T. 16 N.
T. 15 N.
ISABELLA COUNTY
31
32
6
5
W A R R
G E N E
CEMETERY
ROAD
BURNS
COLEMAN
PtB
Pa
Kg
CoB
PsB
Be
AeB
WxB
PxB
LxA
CsB
OaB
Ad
Kn
w
Pa

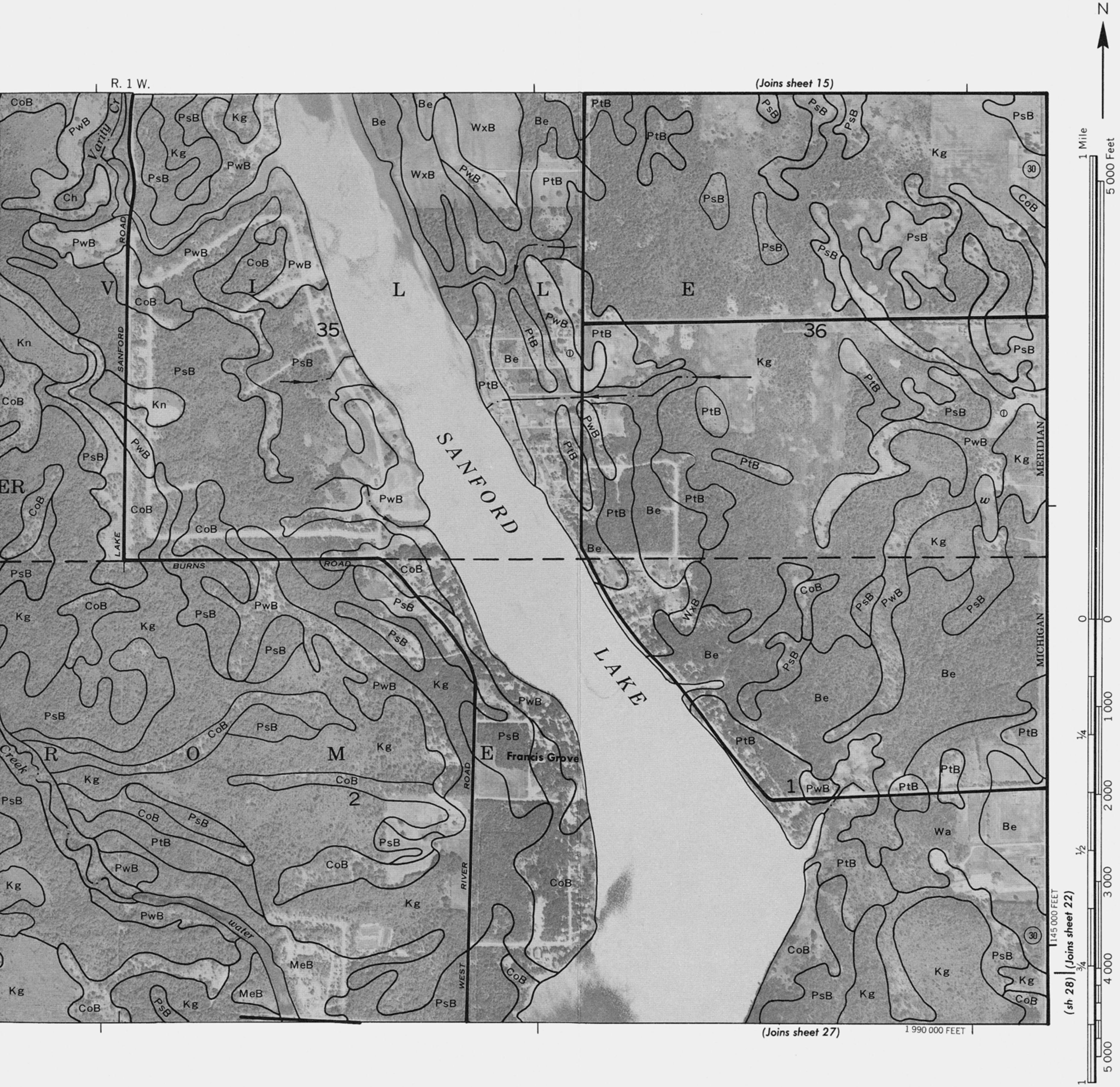

N
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
0
1 000
2 000
3 000
4 000
5 000
(Joins sheet 14)
(Joins sheet 19)
(Joins sheet 26)
R. 2 W.
R. 1 W.
1 950 000 FEET
145 000 FEET
W A R R E N
G E N E V A
J
E
35
36
2
1
BURNS ROAD
MAGRUDDER ROAD
CHESAPEAKE AND OHIO
10
18
water
w
LxA
Be
PtB
PsB
CoB
WxB
Kg
AeB
BoB
PwB
Le
LrB
CsB
Wa
Sz

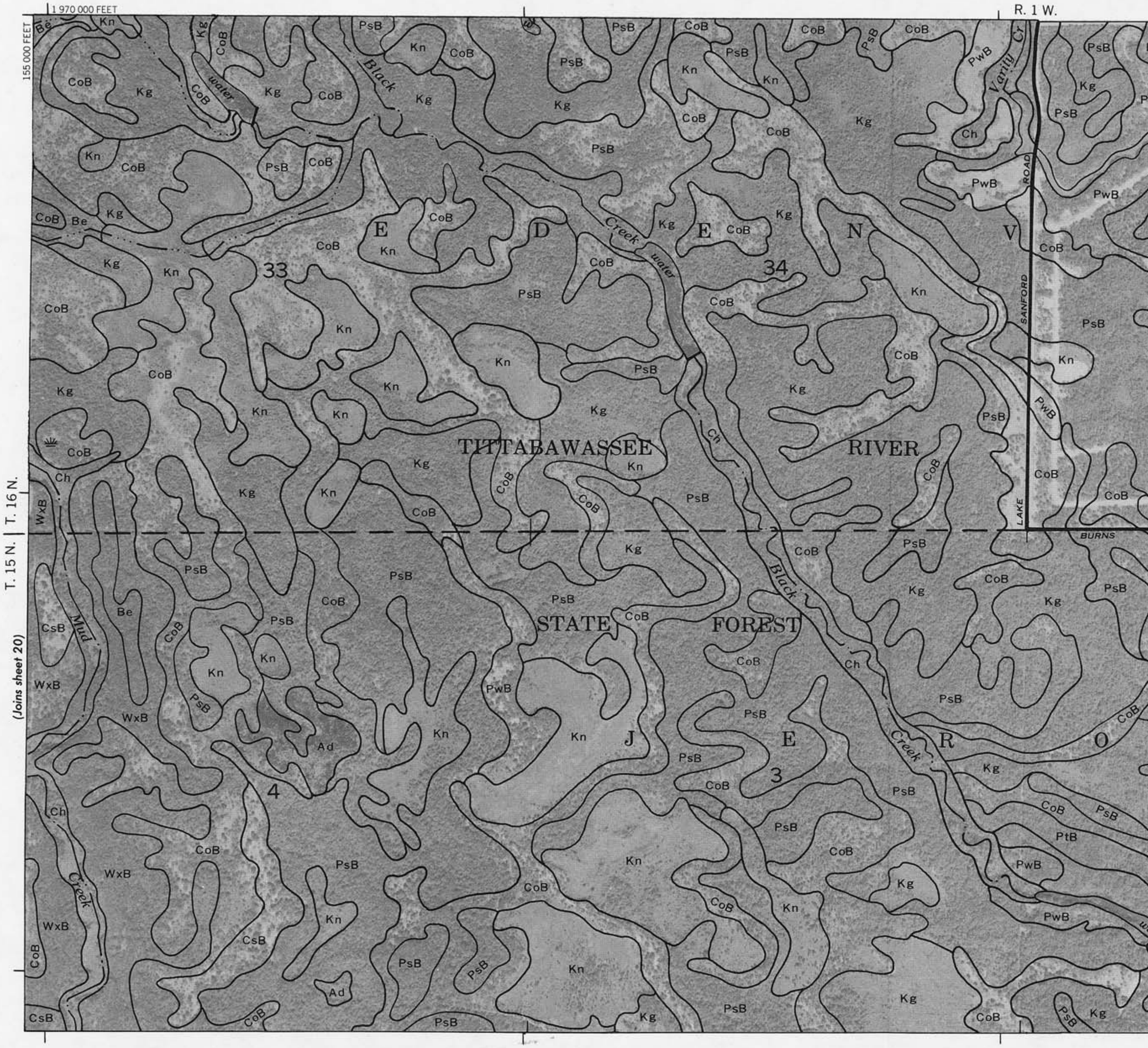
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 20


R. 2 W.
R. 1 W.
1 965 000 FEET
155 000 FEET
T. 16 N.
T. 15 N.
(Joins sheet 21)
E D E N V I L L E
J E R O M E
TITTABAWASSEE RIVER
STATE FOREST
31
32
6
5
Mud Creek
Bluff Creek
Bluff Creek
water
water
18
18
18
10
w
PwB
PtB
PsB
Be
WxB
Ch
CsB
Kn
CoB
Kg
Le
AeB
CsB
LrB
BoB
Wa
MeB
Ch

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 1 W.
(Joins sheet 15)
(Joins sheet 27)
(Joins sheet 22)
(sh 28)
1 990 000 FEET
145 000 FEET
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
SANFORD LAKE
V I L L E
R O M E
ER
35
36
2
1
SANFORD LAKE ROAD
BURNS ROAD
WEST RIVER ROAD
MERIDIAN
MICHIGAN
Francis Grove
Varity Cr
Creek
water
30
CoB
PwB
PsB
Kg
Ch
Kn
Be
WxB
PtB
MeB
Wa
w

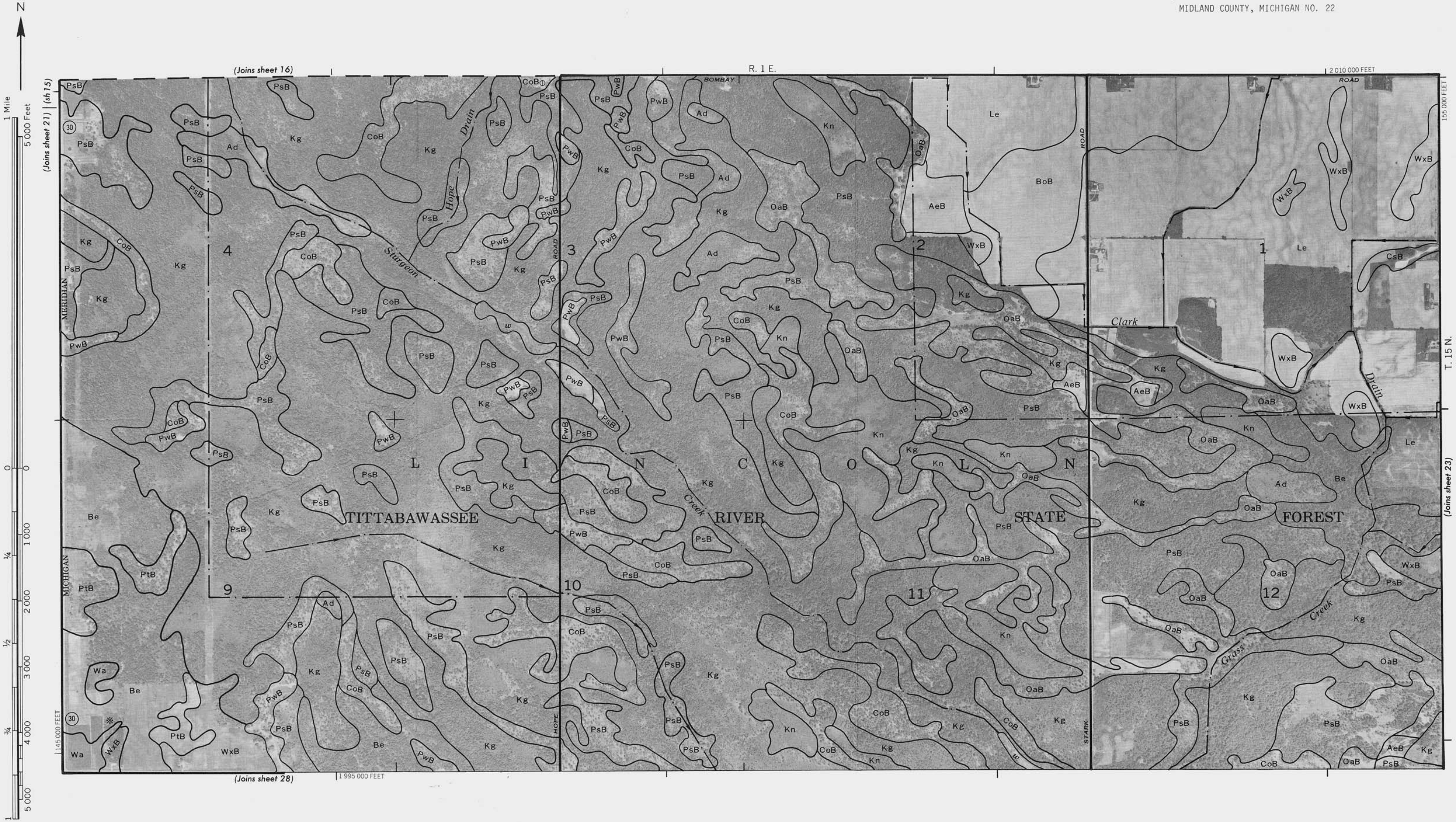

1 970 000 FEET
155 000 FEET
R. 1 W.
T. 16 N.
T. 15 N.
(Joins sheet 20)
TITTABAWASSEE RIVER
STATE FOREST
E D E N V
J E R O
33
34
4
3
Black Creek
water
Mud Creek
Varity Cr
SANFORD LAKE ROAD
BURNS
Ad
Be
Ch
CoB
CsB
Kg
Kn
PsB
PtB
PwB
WxB

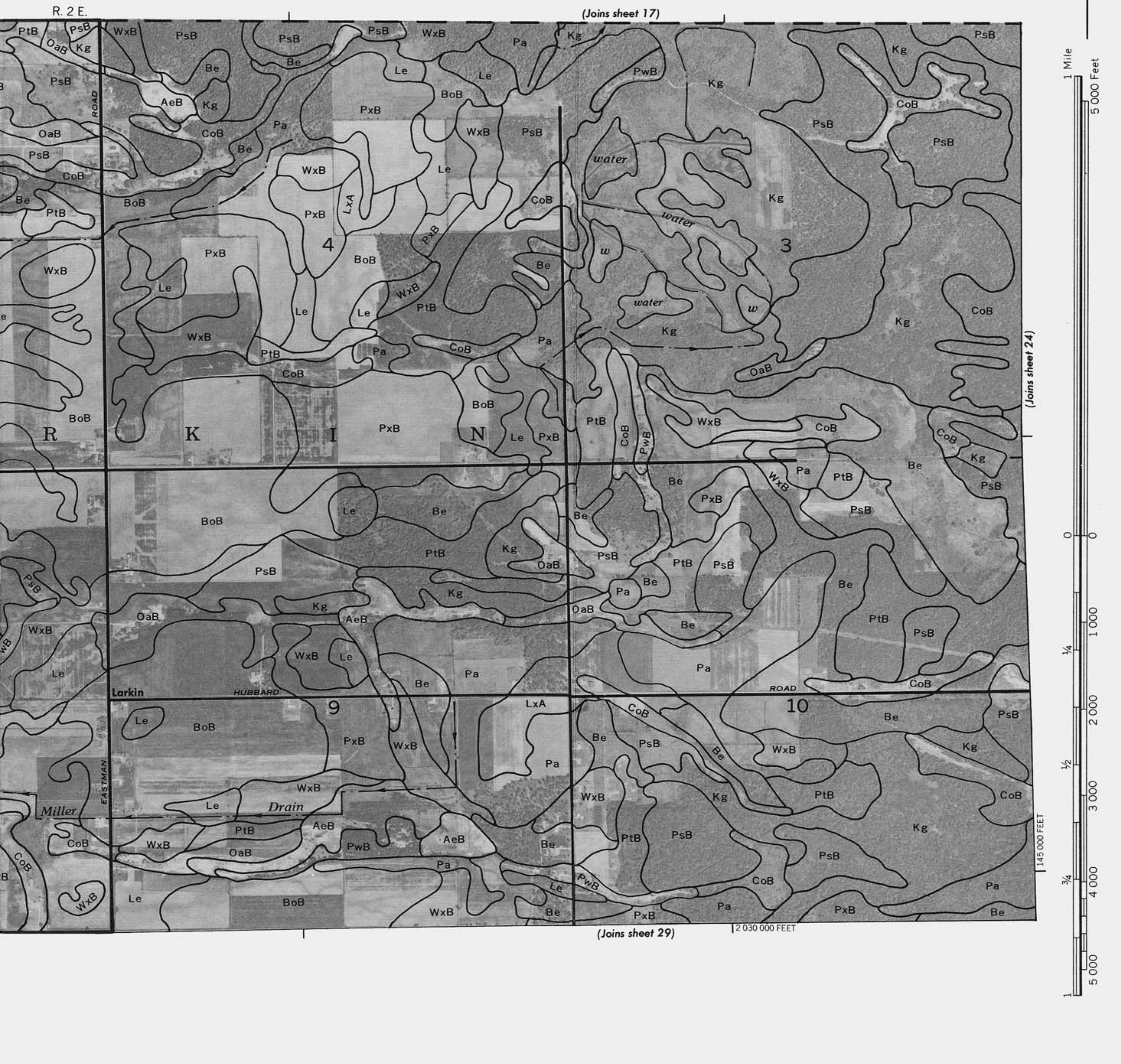
㉒

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 22

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 22

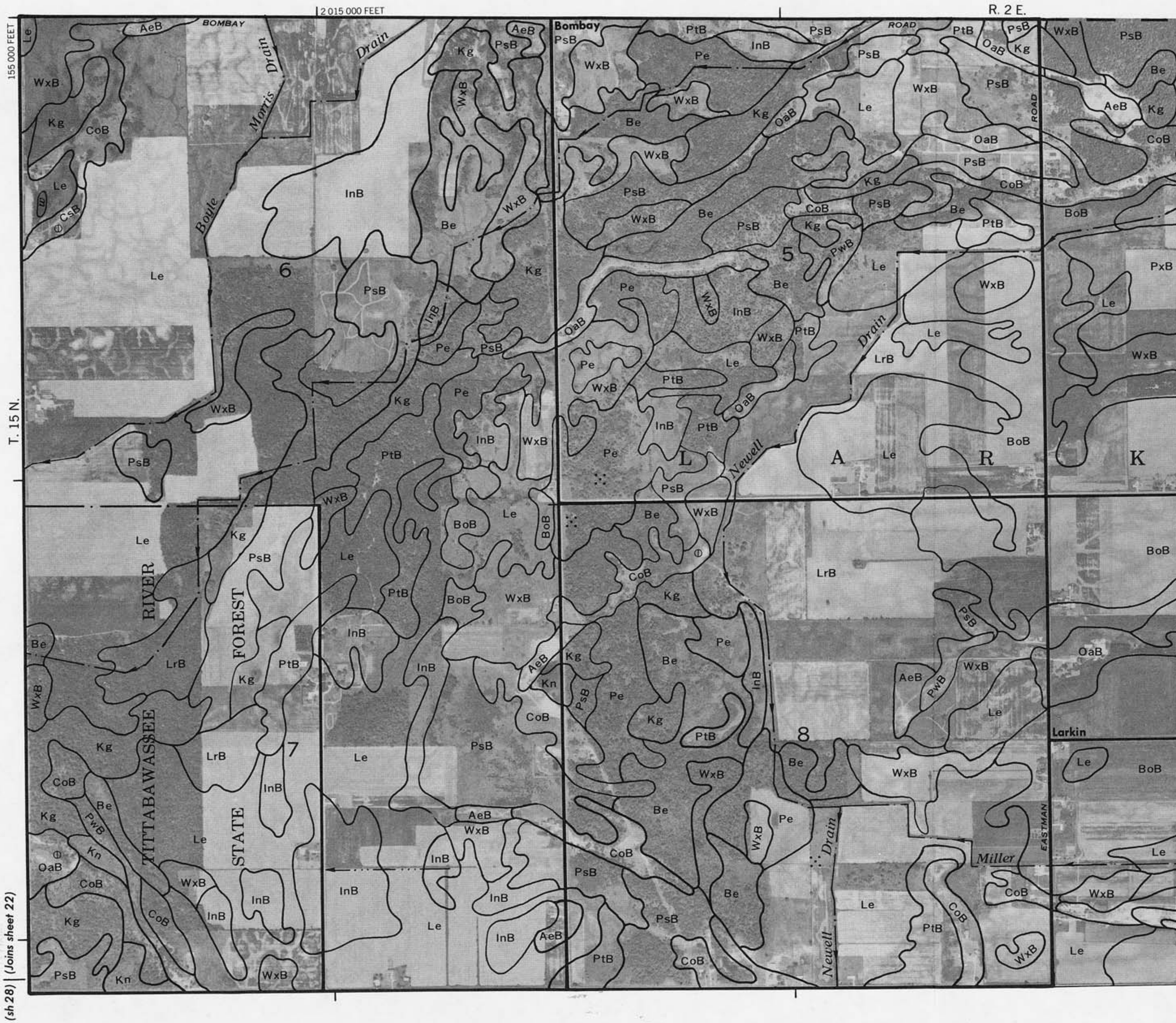

N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
(Joins sheet 16)
(Joins sheet 21) | (sh 15)
(Joins sheet 23)
(Joins sheet 28)
R. 1 E.
T. 15 N.
2 010 000 FEET
155 000 FEET
1 995 000 FEET
145 000 FEET
30
BOMBAY
ROAD
MERIDIAN
MICHIGAN
HOPE
ROAD
STARK
ROAD
Sturgeon
Hope
Drain
Creek
Clark
Drain
Grass
Creek
LINCOLN
TITTABAWASSEE
RIVER
STATE
FOREST
1
2
3
4
9
10
11
12
Ad
AeB
Be
BoB
CoB
CsB
Kg
Kn
Le
OaB
PsB
PtB
PwB
Wa
WxB
w


R. 2 E.
(Joins sheet 17)
(Joins sheet 24)
(Joins sheet 29)
4
3
9
10
R
K
I
N
Larkin
HUBBARD
ROAD
EASTMAN
Miller
Drain
water
w
145 000 FEET
2 030 000 FEET
N
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
PtB
PsB
OaB
Kg
WxB
Be
AeB
CoB
BoB
Pa
Le
PxB
LxA
PwB

MIDLAND COUNTY, MICHIGAN NO.23

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

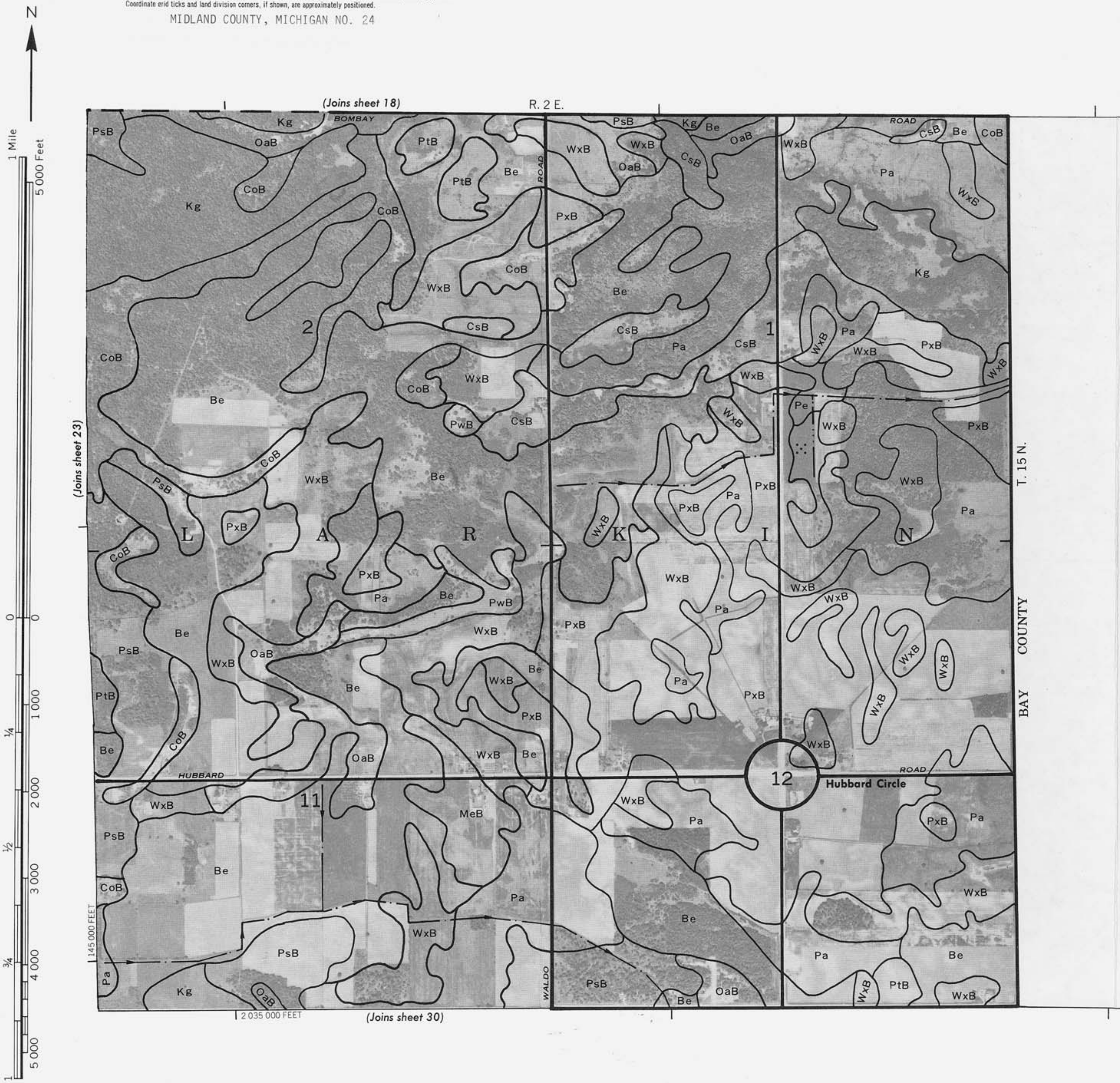
MIDLAND COUNTY, MICHIGAN — SHEET

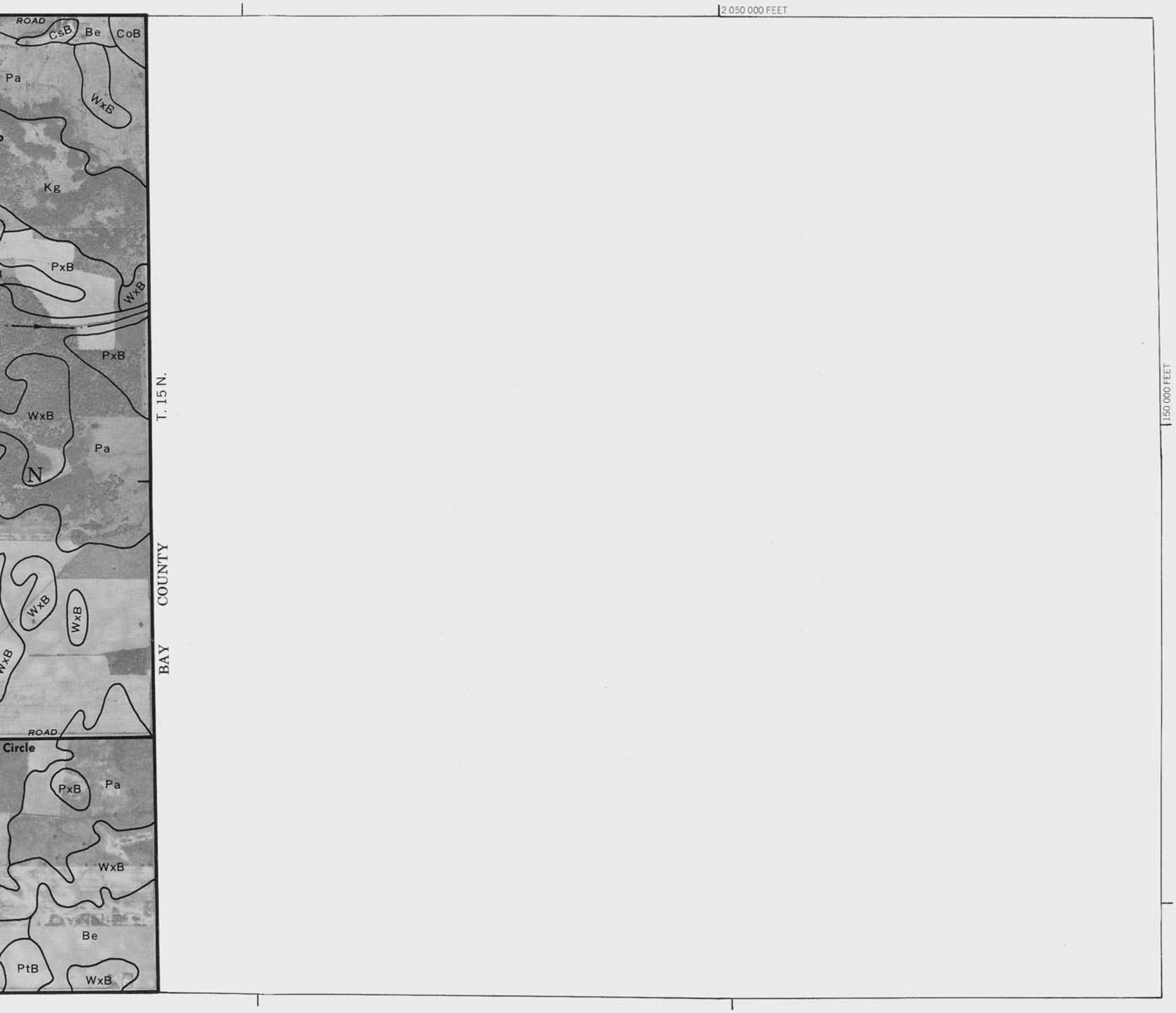


2 015 000 FEET
R. 2 E.
155 000 FEET
T. 15 N.
(sh 28) | (Joins sheet 22)
BOMBAY
ROAD
Bombay
Boyle
Morris
Drain
Drain
Drain
Newell
Newell
Drain
Miller
EASTMAN
ROAD
Larkin
TITTABAWASSEE
RIVER
STATE
FOREST
P
A
R
K
L
A
R
K
6
5
7
8
Le
AeB
AeB
PsB
PtB
InB
PsB
PtB
OaB
PsB
Kg
WxB
PsB
WxB
Kg
Pe
WxB
Be
Kg
OaB
Le
WxB
PsB
AeB
Kg
Kg
CoB
Be
Le
CsB
WxB
InB
Be
WxB
PsB
WxB
Be
PsB
OaB
PsB
CoB
Kg
CoB
Kg
PsB
Be
PtB
CoB
BoB
Le
PsB
Kg
5
PwB
Le
Be
Pe
WxB
InB
PxB
WxB
Le
Pe
PsB
OaB
Pe
WxB
PtB
Le
WxB
PtB
Le
LrB
Le
WxB
WxB
Kg
Pe
PtB
InB
WxB
InB
PtB
OaB
Pe
BoB
PsB
PsB
WxB
BoB
Le
BoB
Be
WxB
Le
Kg
PsB
Le
CoB
Kg
LrB
BoB
PtB
BoB
WxB
InB
PsB
Be
LrB
Kg
PtB
InB
AeB
Kg
Pe
Be
OaB
WxB
Kn
PsB
Pe
InB
WxB
AeB
PwB
Le
Kg
LrB
CoB
Kg
PtB
Le
PsB
Be
WxB
Le
BoB
CoB
InB
Be
WxB
Kg
Be
PwB
AeB
WxB
Be
Pe
OaB
Kn
CoB
WxB
CoB
Le
Le
WxB
InB
CoB
Be
CoB
WxB
PsB
InB
Le
InB
PsB
Le
PtB
Kg
InB
PsB
Le
InB
AeB
CoB
WxB
PsB
Kn
WxB
PtB
CoB
Le

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

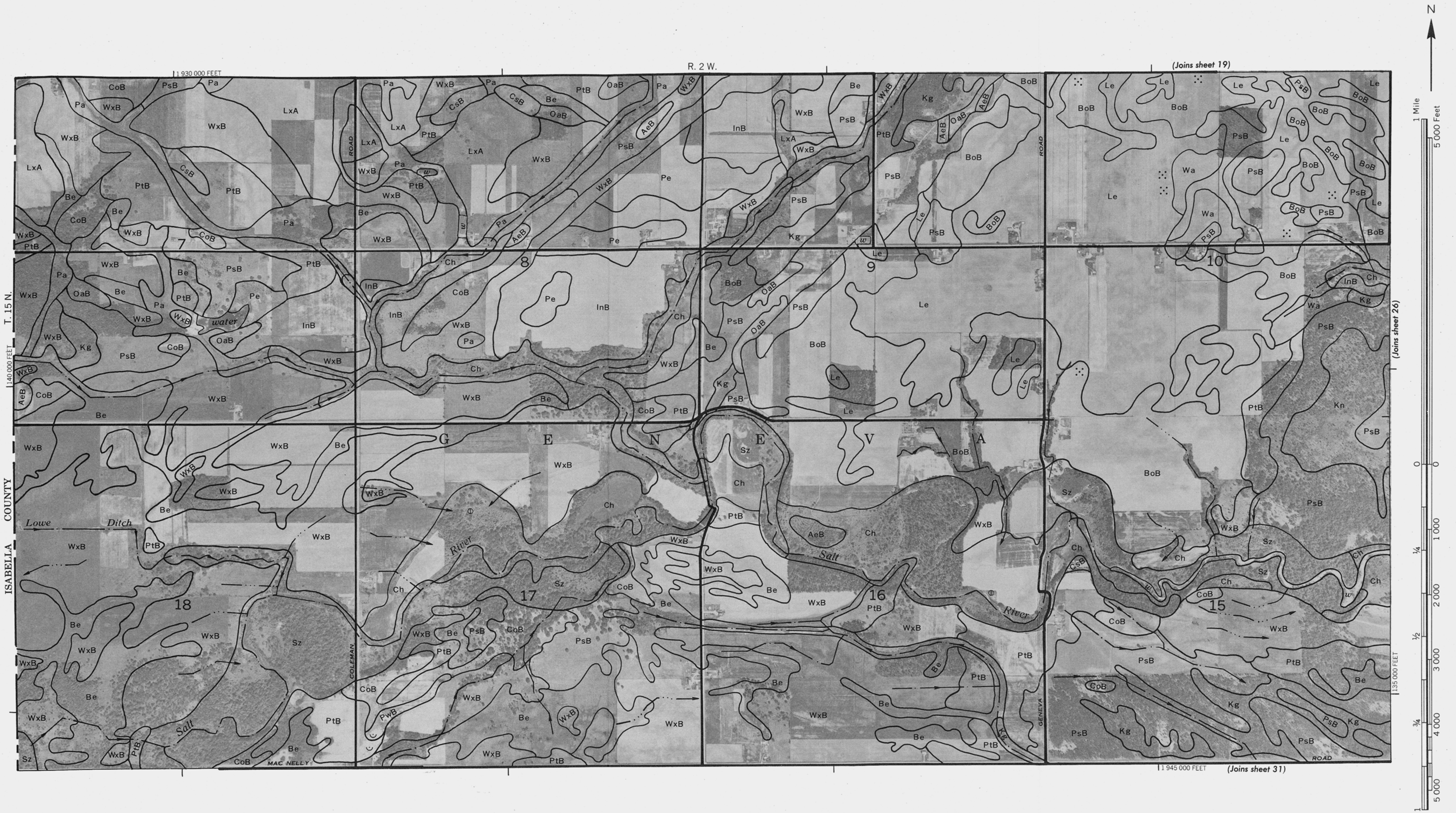
MIDLAND COUNTY, MICHIGAN NO. 24


N
1 Mile
5 000 Feet
0
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
1
(Joins sheet 18)
R. 2 E.
BOMBAY
ROAD
ROAD
(Joins sheet 23)
T. 15 N.
BAY COUNTY
L A R K I N
HUBBARD
ROAD
Hubbard Circle
WALDO
(Joins sheet 30)
2 035 000 FEET
145 000 FEET
1
2
11
12
PsB
Kg
OaB
PtB
PtB
Be
PsB
Kg
Be
OaB
WxB
WxB
OaB
CsB
WxB
CsB
Be
CoB
Pa
WxB
CoB
Kg
CoB
PxB
CoB
WxB
CsB
Be
Kg
CsB
Pa
CsB
WxB
Pa
WxB
PxB
WxB
CoB
Be
CoB
WxB
PwB
CsB
WxB
WxB
Pe
WxB
PxB
CoB
PsB
WxB
Be
PxB
Pa
PxB
WxB
Pa
PxB
WxB
CoB
PxB
Pa
Be
PwB
WxB
Pa
WxB
WxB
Be
PsB
WxB
OaB
WxB
PxB
WxB
Pa
WxB
PtB
Be
WxB
Be
PxB
Pa
PxB
WxB
WxB
CoB
OaB
WxB
Be
WxB
Be
WxB
WxB
MeB
Pa
PxB
Pa
PsB
Be
CoB
Pa
WxB
Be
WxB
PsB
Pa
Kg
OaB
PsB
Be
OaB
Pa
WxB
PtB
Be
WxB


2 050 000 FEET
150 000 FEET
ROAD
CsB
Be
CoB
Pa
WxB
Kg
PxB
WxB
PxB
WxB
Pa
N
WxB
WxB
WxB
ROAD
T. 15 N.
BAY COUNTY
Circle
PxB
Pa
WxB
Be
PtB
WxB

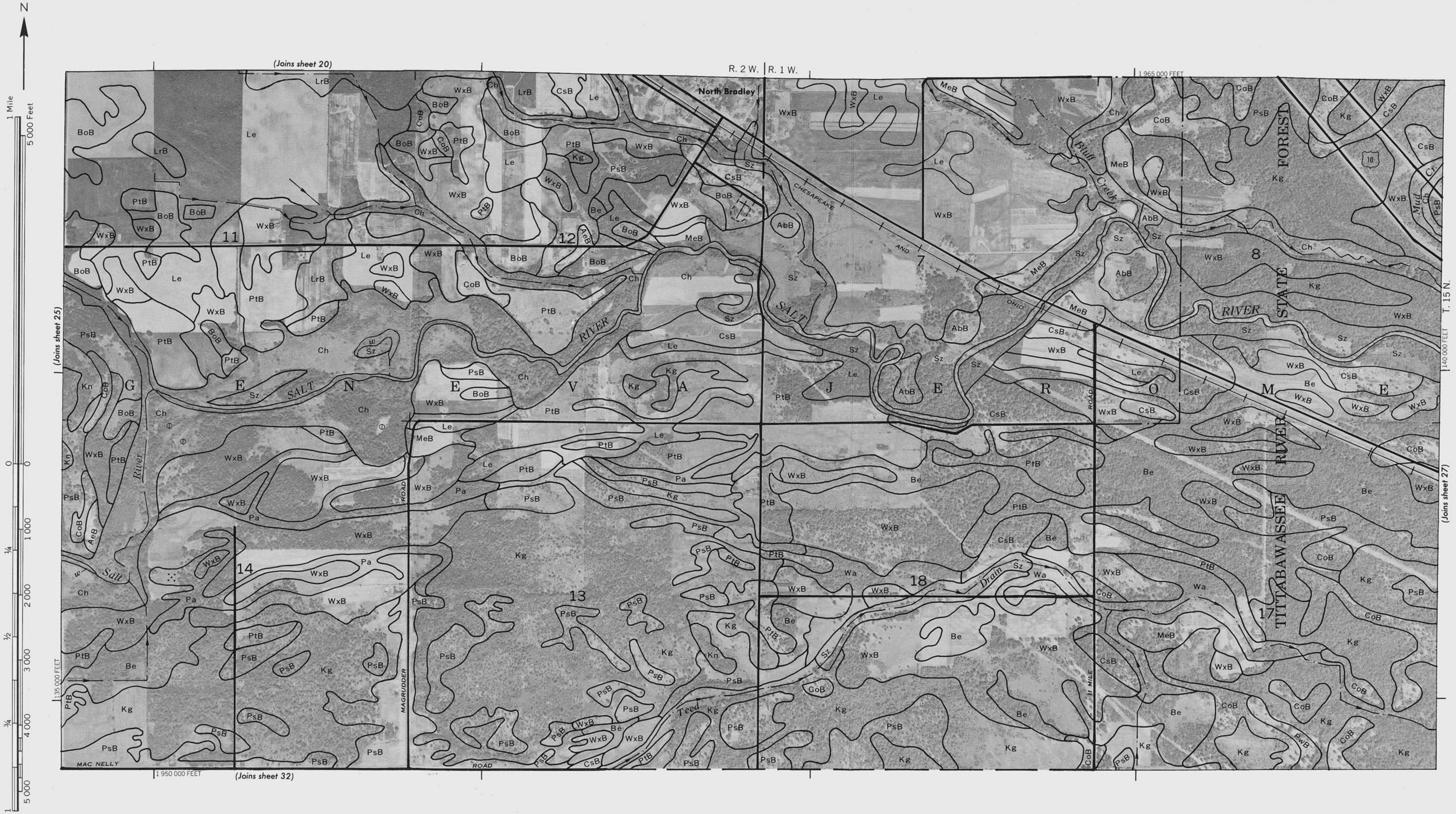
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 25

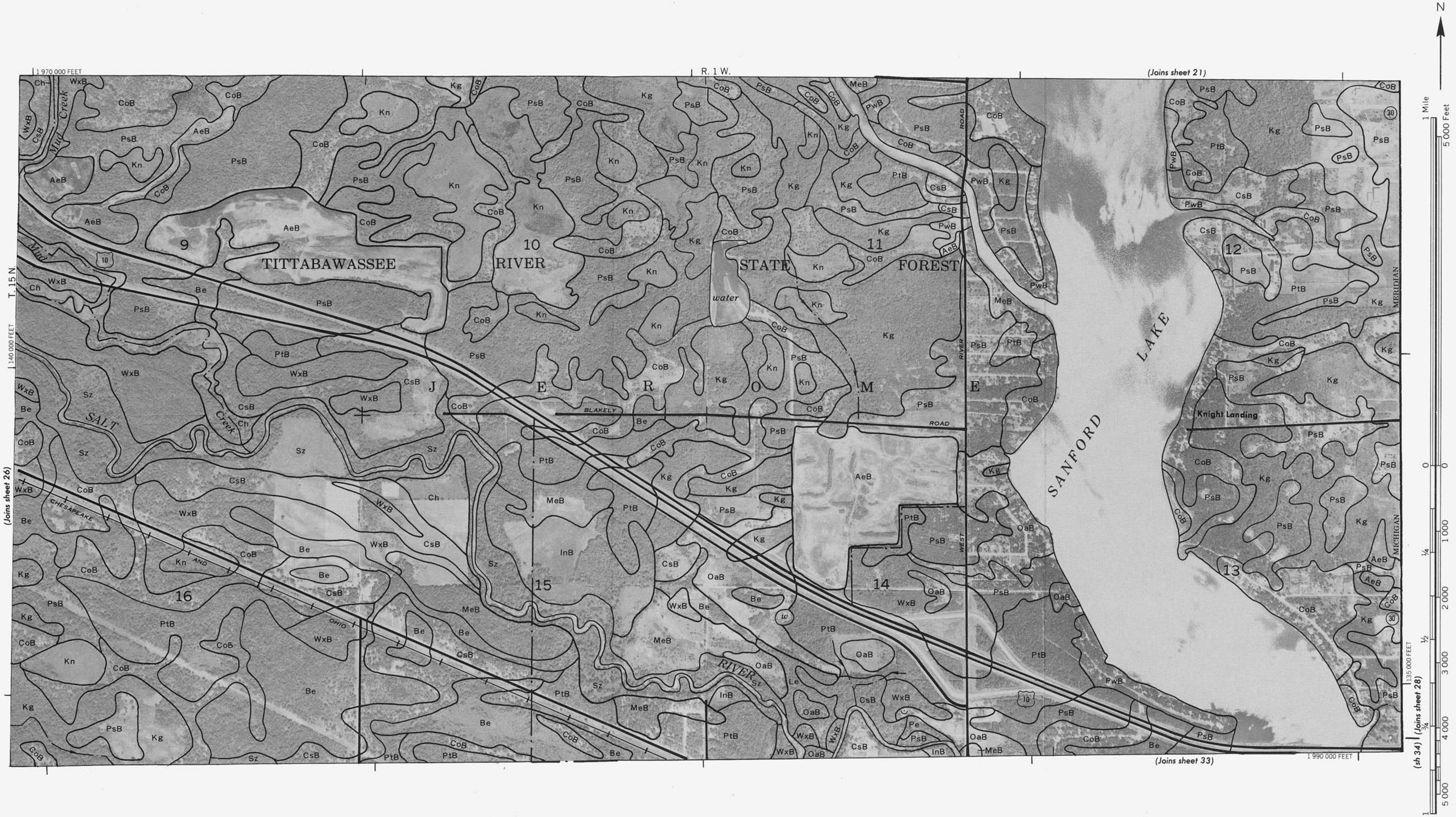

N
R. 2 W.
1 930 000 FEET
(Joins sheet 19)
(Joins sheet 26)
(Joins sheet 31)
1 945 000 FEET
140 000 FEET
135 000 FEET
T. 15 N.
ISABELLA COUNTY
Lowe Ditch
Salt River
G E N E V A
ROAD
COLEMAN
MAC NELLY
GENEVA
7
8
9
10
15
16
17
18
water
w
CoB
PsB
Pa
WxB
LxA
PtB
CsB
Be
OaB
AeB
InB
Pe
Ch
Kg
BoB
Le
Wa
Kn
Sz
PwB
1 Mile
5 000 Feet
0
1000
1/4
2 000
1/2
3 000
3/4
4 000
1
5 000

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 26

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
0
1/4
1/2
3/4
1
(Joins sheet 20)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 32)
R. 2 W.
R. 1 W.
T. 15 N.
1 965 000 FEET
1 950 000 FEET
135 000 FEET
140 000 FEET
North Bradley
GENEVA
JEROME
TITTABAWASSEE RIVER STATE FOREST
SALT RIVER
Salt River
Bluff Creek
Mud Cr
Teed Drain
CHESAPEAKE AND OHIO
MAGRUDDER ROAD
MAC NELLY ROAD
11 MILE ROAD
10
7
8
11
12
13
14
17
18

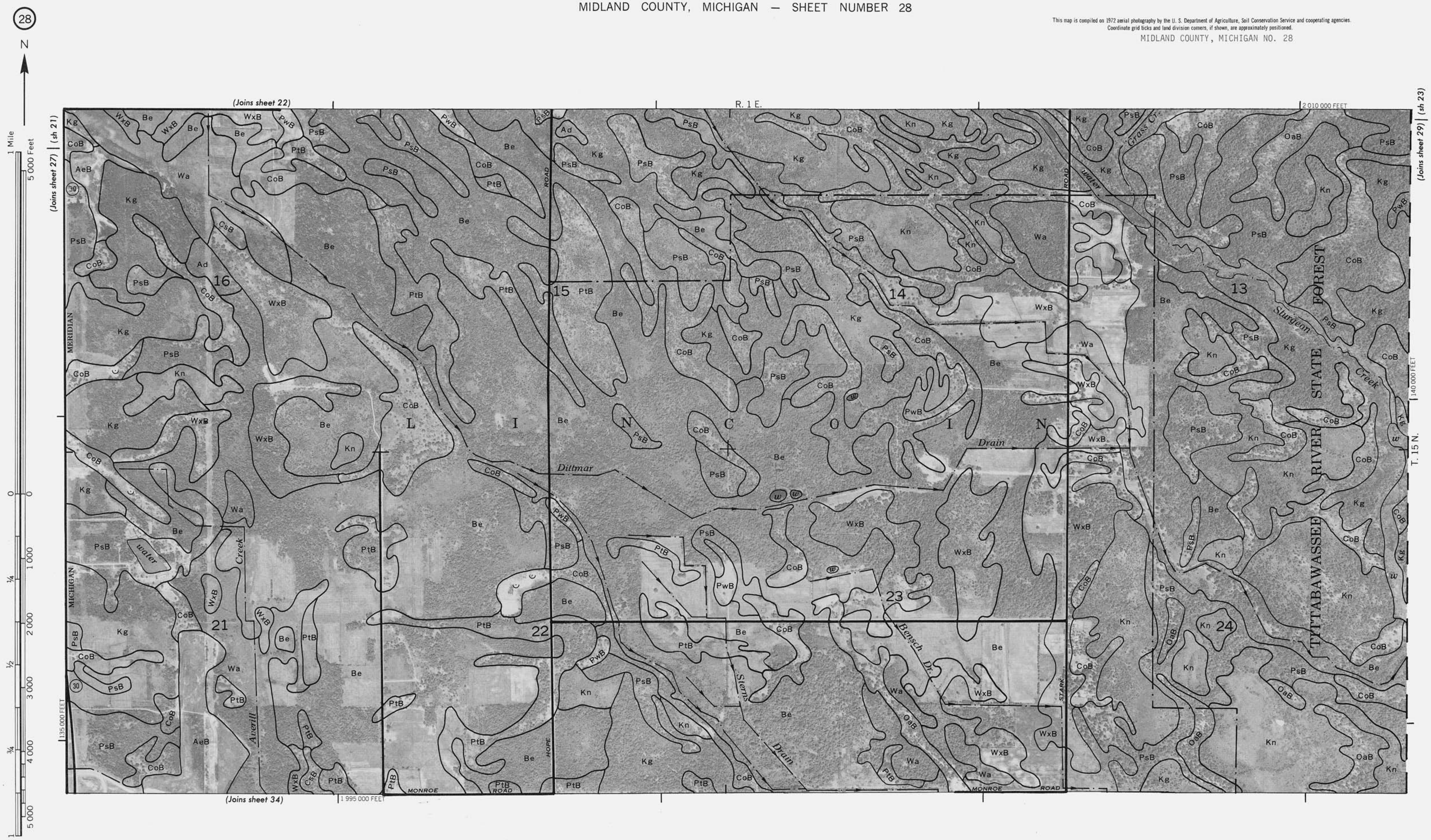
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 970 000 FEET
R. 1 W.
(Joins sheet 21)
(Joins sheet 26)
(Joins sheet 28)
(sh 34)
(Joins sheet 33)
1 990 000 FEET
T. 15 N.
140 000 FEET
135 000 FEET
TITTABAWASSEE RIVER STATE FOREST
JEROME
SANFORD LAKE
SALT Creek
Mud Creek
Mud
RIVER
CHESAPEAKE AND OHIO
BLAKELY ROAD
WEST RIVER ROAD
MERIDIAN
MICHIGAN
Knight Landing
water
w
10
30
9
10
11
12
13
14
15
16
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5 000
¼
½
¾
AeB
Be
Ch
CoB
CsB
InB
Kg
Kn
Le
MeB
OaB
Pe
PsB
PtB
PwB
Sz
WxB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 28

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 28

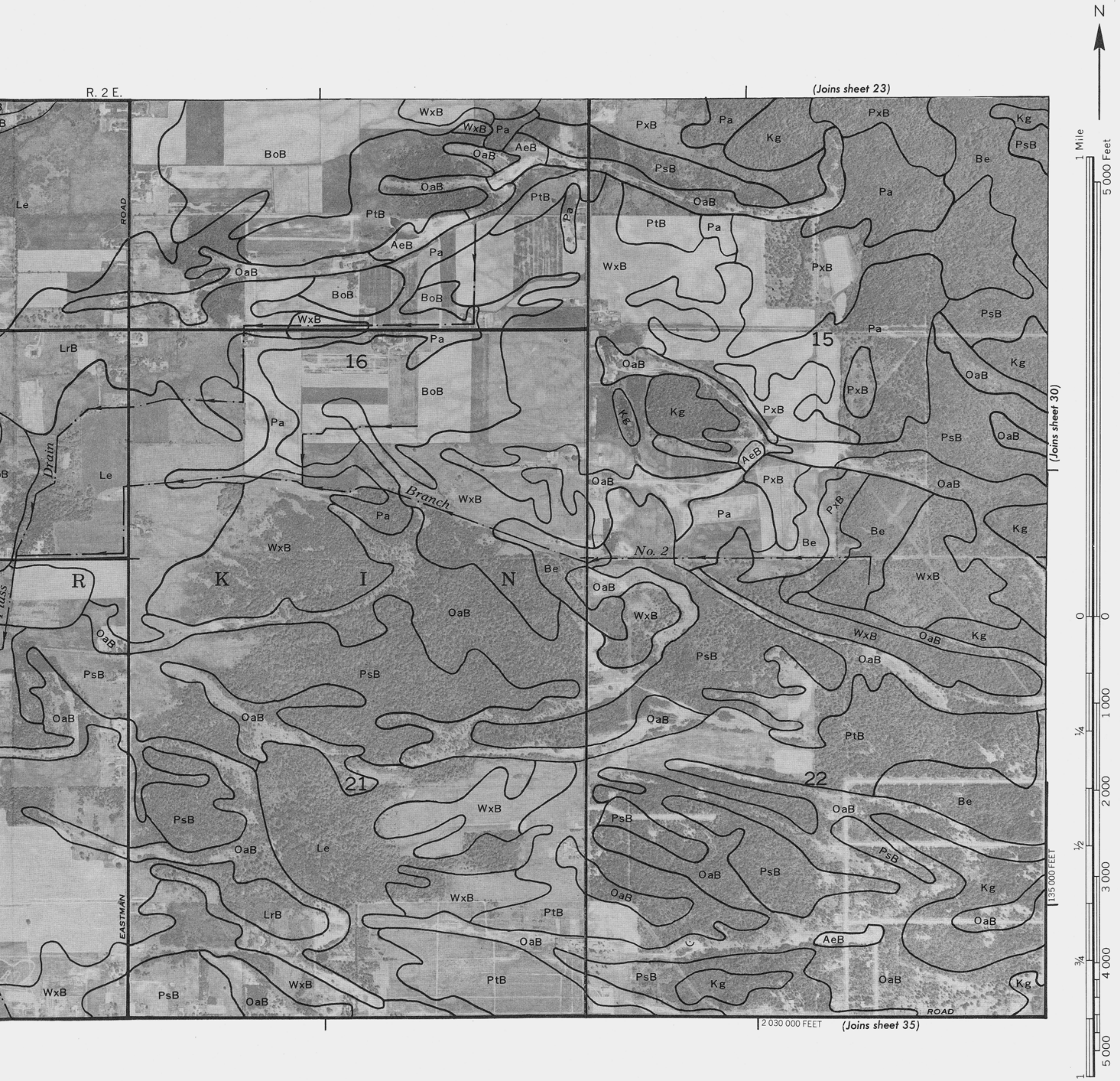


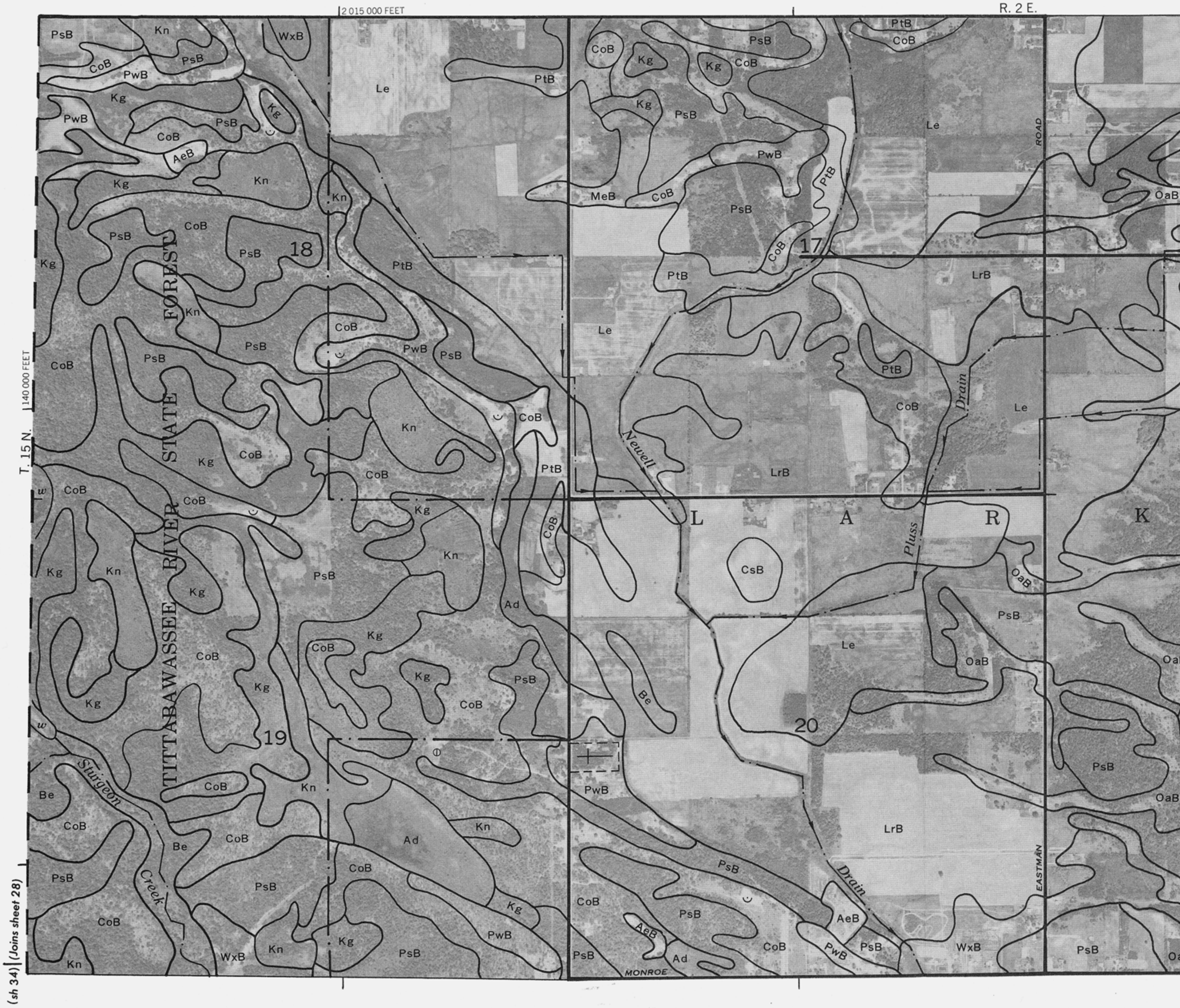
28
N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
(Joins sheet 22)
(Joins sheet 27) | (sh 21)
(Joins sheet 29) | (sh 23)
(Joins sheet 34)
R. 1 E.
T. 15 N.
2 010 000 FEET
140 000 FEET
135 000 FEET
1 995 000 FEET
MICHIGAN
MERIDIAN
ROAD
HOPE
MONROE
STARK
30
16
15
14
13
21
22
23
24
L I N C O L N
TITTABAWASSEE RIVER STATE FOREST
Dittmar
Drain
Bensch Dr.
Sterns
Drain
Averill
Creek
Sturgeon
Creek
Grass Cr.
water
w
Kg
CoB
AeB
PsB
Kn
WxB
Be
Wa
PwB
PtB
Ad
CsB
OaB

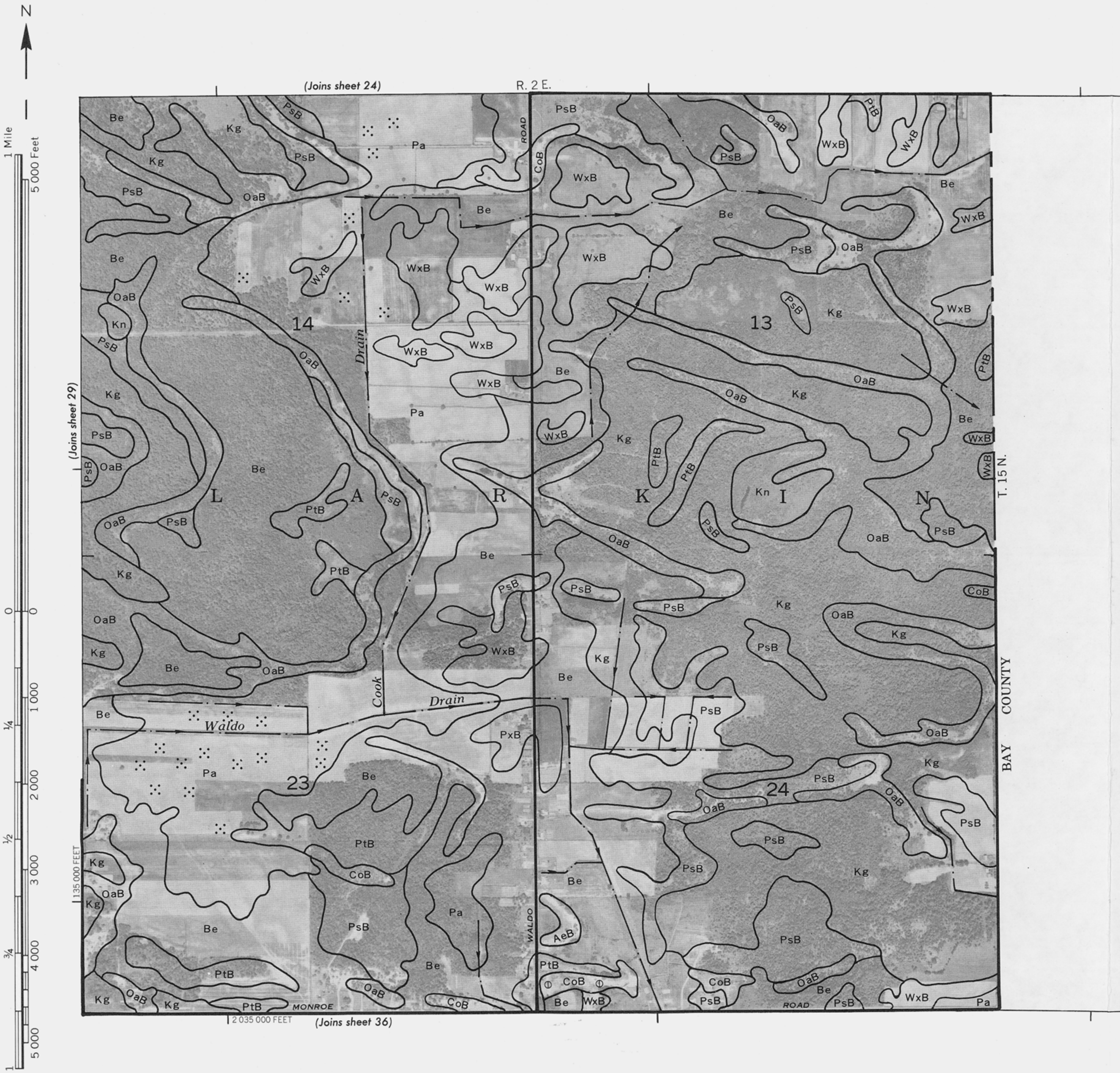
COUNTY, MICHIGAN — SHEET NUMBER 29

MIDLAND COUNTY, MICHIGAN NO. 29

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 2 E.
(Joins sheet 23)
(Joins sheet 30)
(Joins sheet 35)
2 030 000 FEET
135 000 FEET
1 Mile
5 000 Feet
0
1 000
¼
2 000
½
3 000
¾
4 000
1
5 000
ROAD
EASTMAN
ROAD
Drain
Branch
No. 2
Pass
R
K
I
N
15
16
21
22
WxB
WxB
Pa
AeB
OaB
BoB
OaB
PtB
PtB
Pa
AeB
Pa
OaB
BoB
BoB
WxB
Pa
Le
PxB
Pa
Kg
PxB
PsB
Be
PsB
OaB
Pa
PtB
Pa
WxB
PxB
PsB
Pa
LrB
16
BoB
Pa
OaB
Kg
Kg
PxB
PxB
OaB
Kg
PsB
OaB
AeB
PxB
OaB
Le
WxB
Pa
PxB
Pa
Be
Be
Kg
WxB
Be
OaB
WxB
WxB
OaB
OaB
WxB
OaB
Kg
PsB
OaB
PsB
PsB
OaB
OaB
OaB
PtB
PsB
OaB
Le
WxB
OaB
Be
PsB
PsB
OaB
PsB
Kg
OaB
LrB
WxB
PtB
OaB
OaB
AeB
OaB
WxB
PsB
WxB
OaB
PtB
PsB
Kg
OaB
Kg

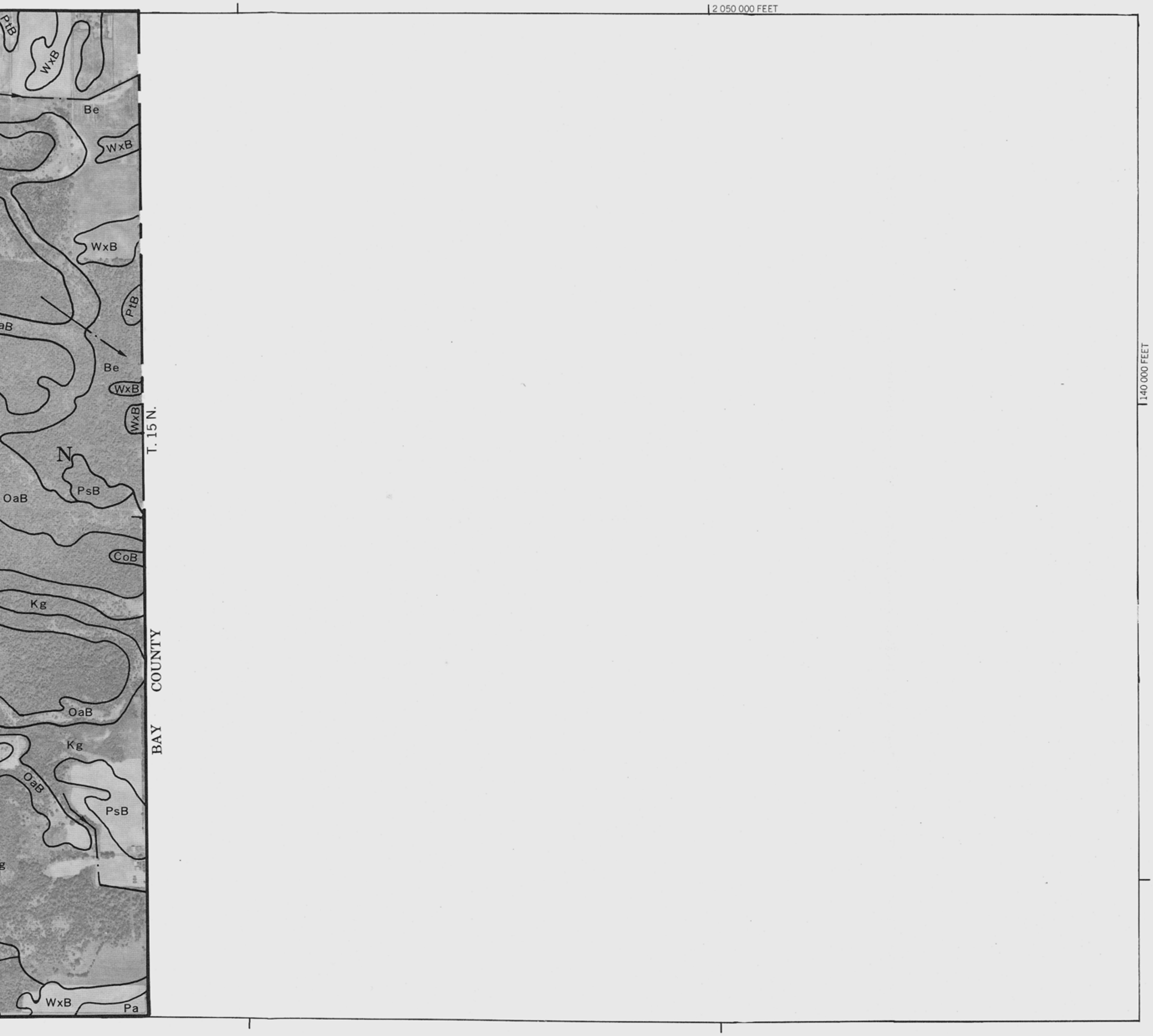

2 015 000 FEET
R. 2 E.
140 000 FEET
T. 15 N.
(sh 34)
(Joins sheet 28)
TITTABAWASSEE RIVER STATE FOREST
L A R K
18
17
19
20
Newell
Pluss
Drain
Sturgeon Creek
ROAD
EASTMAN
MONROE
w
PsB
Kn
WxB
CoB
PwB
Kg
AeB
Le
PtB
MeB
LrB
OaB
CsB
Ad
Be


N
1 Mile
5 000 Feet
0
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
1
(Joins sheet 24)
R. 2 E.
(Joins sheet 29)
T. 15 N.
BAY COUNTY
(Joins sheet 36)
2 035 000 FEET
135 000 FEET
14
13
23
24
L A R K I N
Drain
Cook Drain
Waldo
ROAD
WALDO
MONROE
ROAD
Be
Kg
PsB
OaB
Pa
CoB
WxB
PtB
Kn
PxB
AeB

OUNTY, MICHIGAN — SHEET NUMBER 30

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

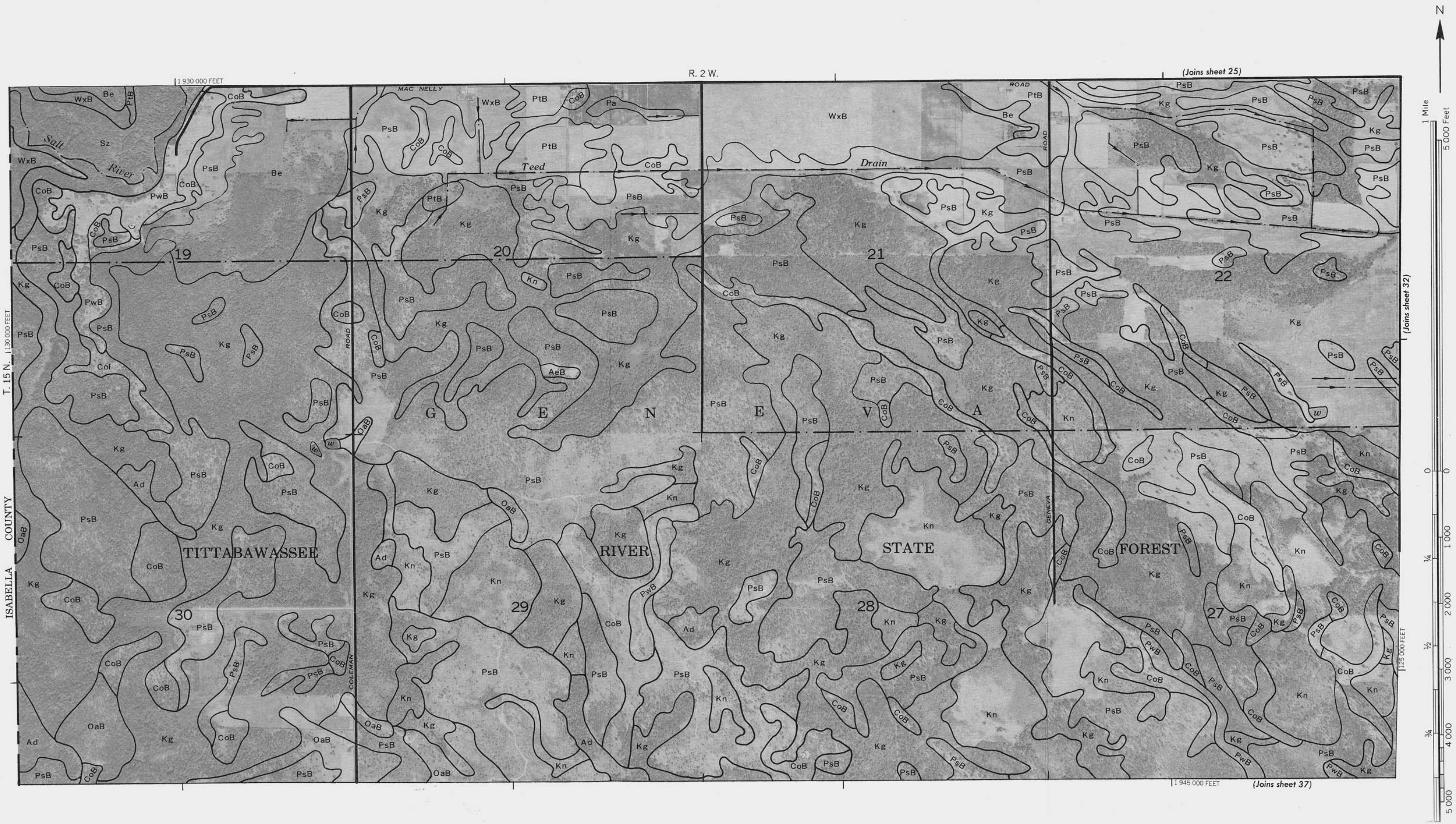
MIDLAND COUNTY, MICHIGAN NO. 30


2 050 000 FEET
140 000 FEET
PtB
WxB
Be
WxB
WxB
PtB
aB
Be
WxB
WxB
T. 15 N.
N
PsB
OaB
CoB
Kg
BAY COUNTY
OaB
Kg
OaB
PsB
g
WxB
Pa

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 31

MIDLAND COUNTY, MICHIGAN NO. 31

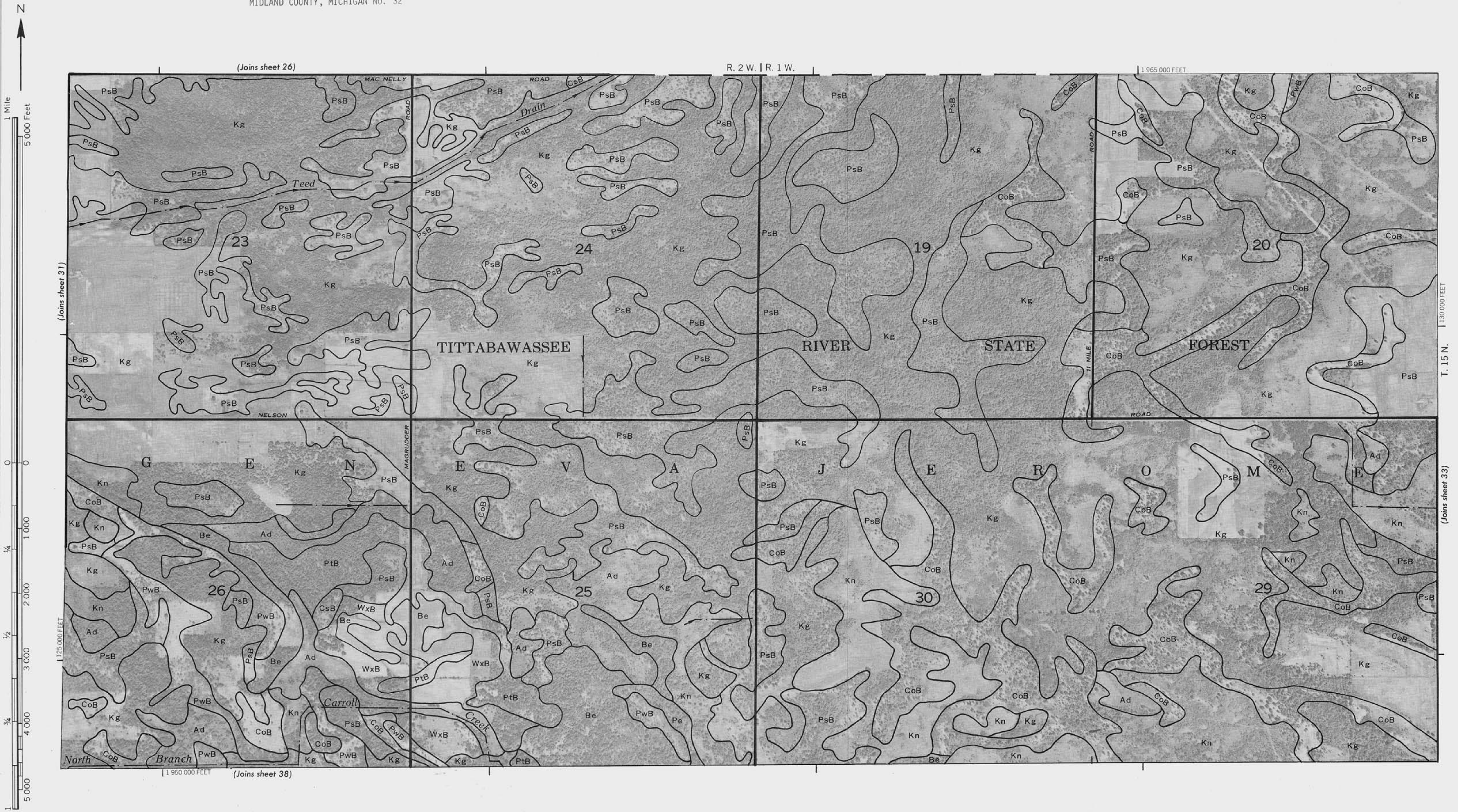
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 2 W.
(Joins sheet 25)
(Joins sheet 32)
(Joins sheet 37)
1 930 000 FEET
1 945 000 FEET
130 000 FEET
125 000 FEET
T. 15 N.
ISABELLA COUNTY
MAC NELLY
ROAD
COLEMAN
GENEVA
Salt River
Teed Drain
G E N E V A
TITTABAWASSEE RIVER STATE FOREST
19
20
21
22
27
28
29
30
1 Mile
5 000 Feet
0
¼
½
¾
1 000
2 000
3 000
4 000
5 000

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 32

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 32

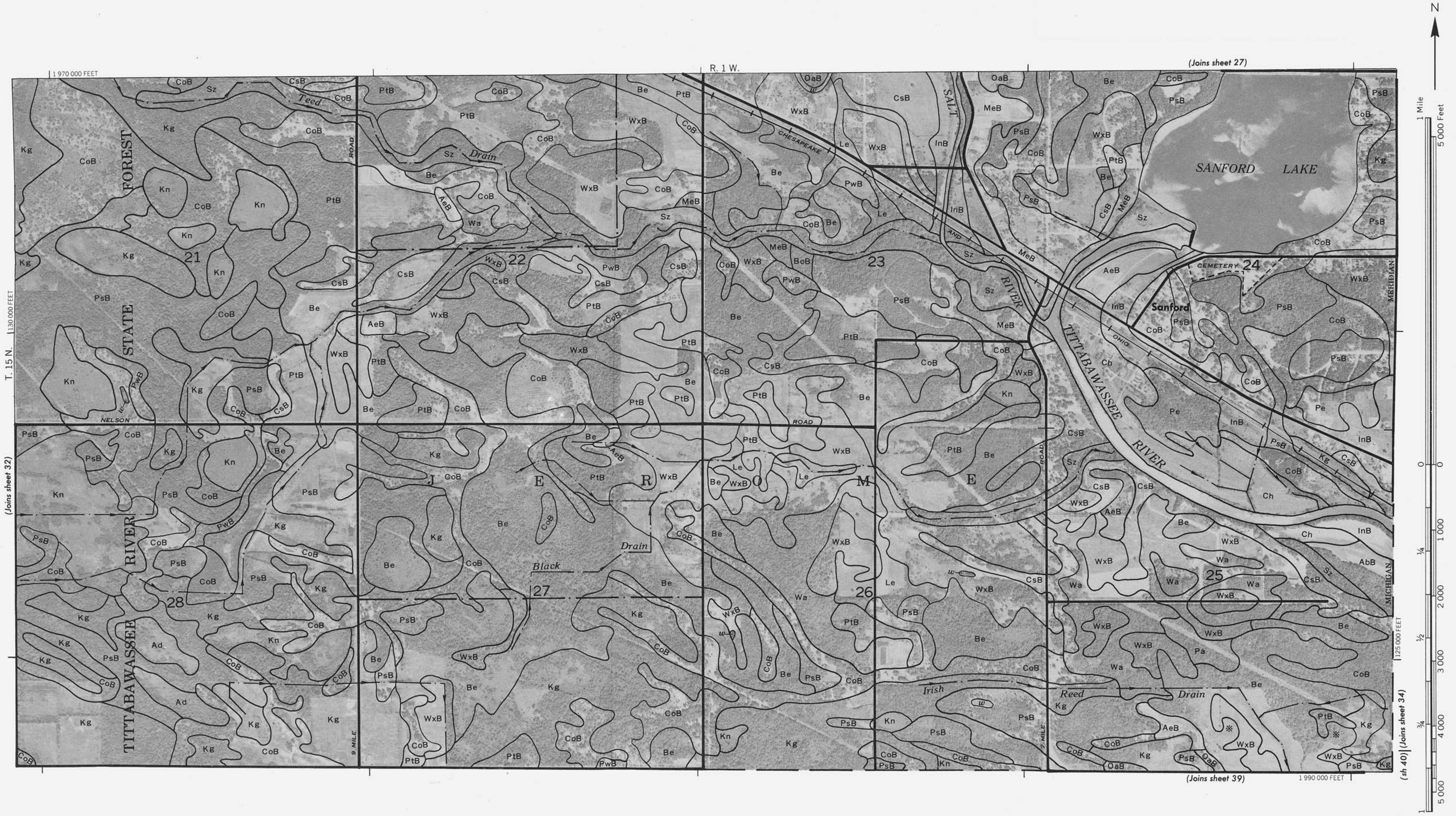

N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
(Joins sheet 26)
R. 2 W. | R. 1 W.
1 965 000 FEET
130 000 FEET
T. 15 N.
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 38)
1 950 000 FEET
125 000 FEET
MAC NELLY ROAD
Teed Drain
MAGRUDDER ROAD
NELSON ROAD
11 MILE ROAD
Carroll Creek
North Branch
TITTABAWASSEE RIVER STATE FOREST
GENEVA
JEROME
23
24
19
20
26
25
30
29
PsB
Kg
CsB
CoB
PwB
Kn
Ad
Be
PtB
WxB
Pe

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 33

MIDLAND COUNTY, MICHIGAN NO. 33

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

㉝

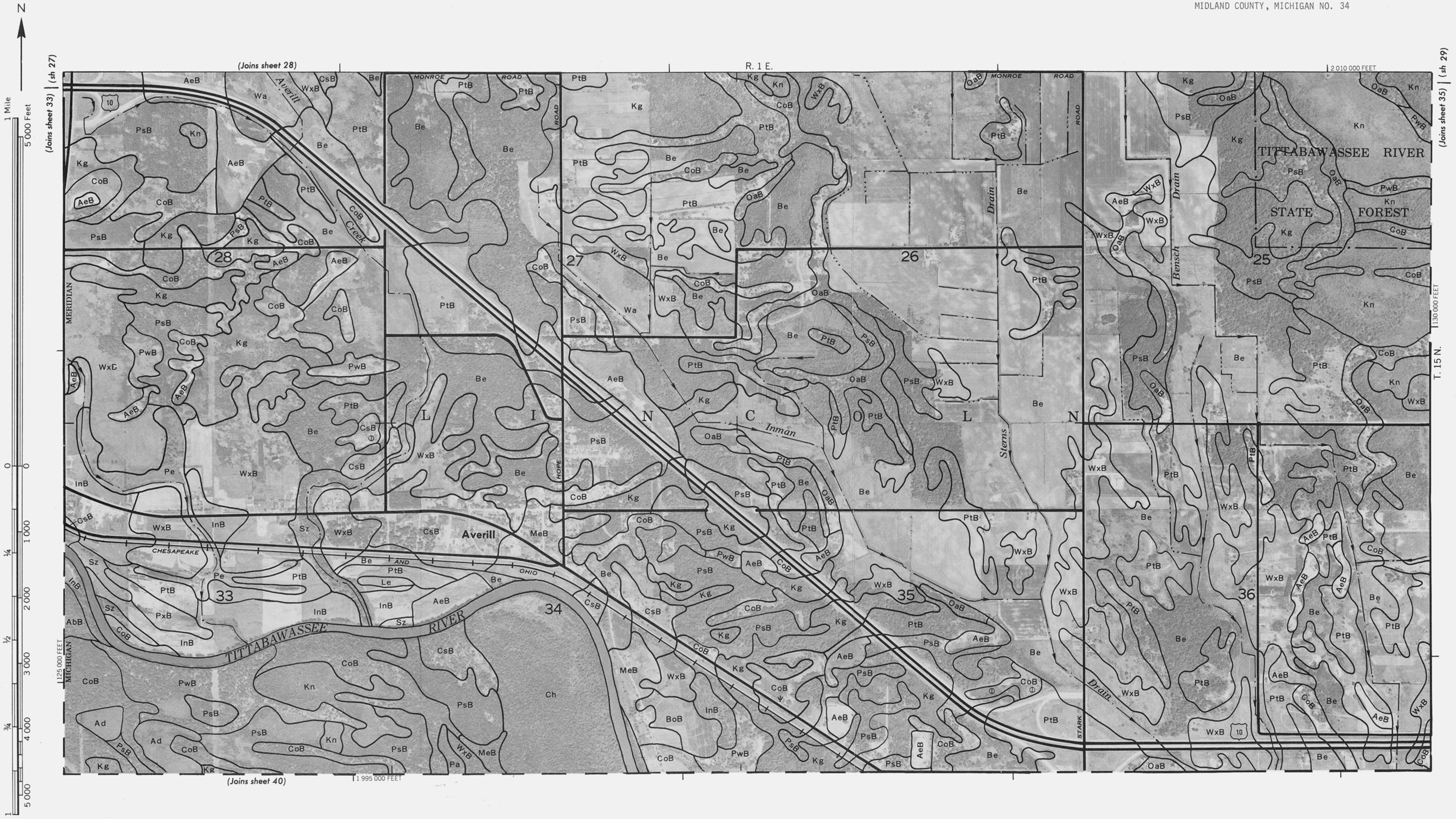

N
(Joins sheet 27)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 39)
(sh 40)
R. 1 W.
T. 15 N.
1 970 000 FEET
1 990 000 FEET
130 000 FEET
125 000 FEET
SANFORD LAKE
Sanford
CEMETERY
SALT RIVER
TITTABAWASSEE RIVER
FOREST
STATE
J E R O M E
CHESAPEAKE AND OHIO
MERIDIAN
MICHIGAN
NELSON
ROAD
9 MILE
7 MILE
Teed Drain
Black Drain
Irish Reed Drain
21
22
23
24
25
26
27
28
CoB
CsB
Sz
Kg
Kn
PsB
PtB
WxB
Be
MeB
AeB
Wa
OaB
InB
Le
PwB
BoB
Ch
Pe
Pa
AbB
Ad
w
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5 000
¼
½
¾
1

③④

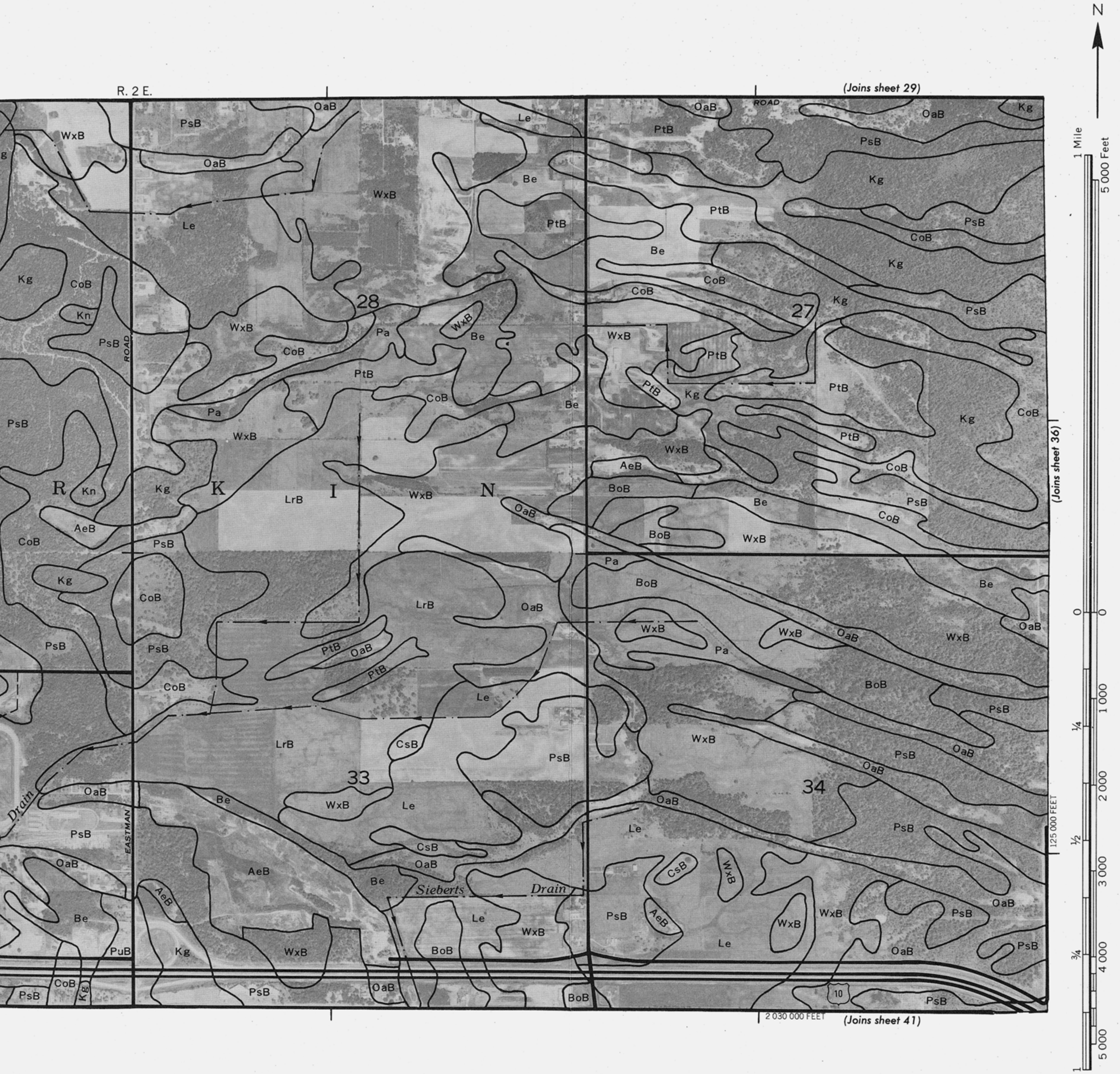
MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 34

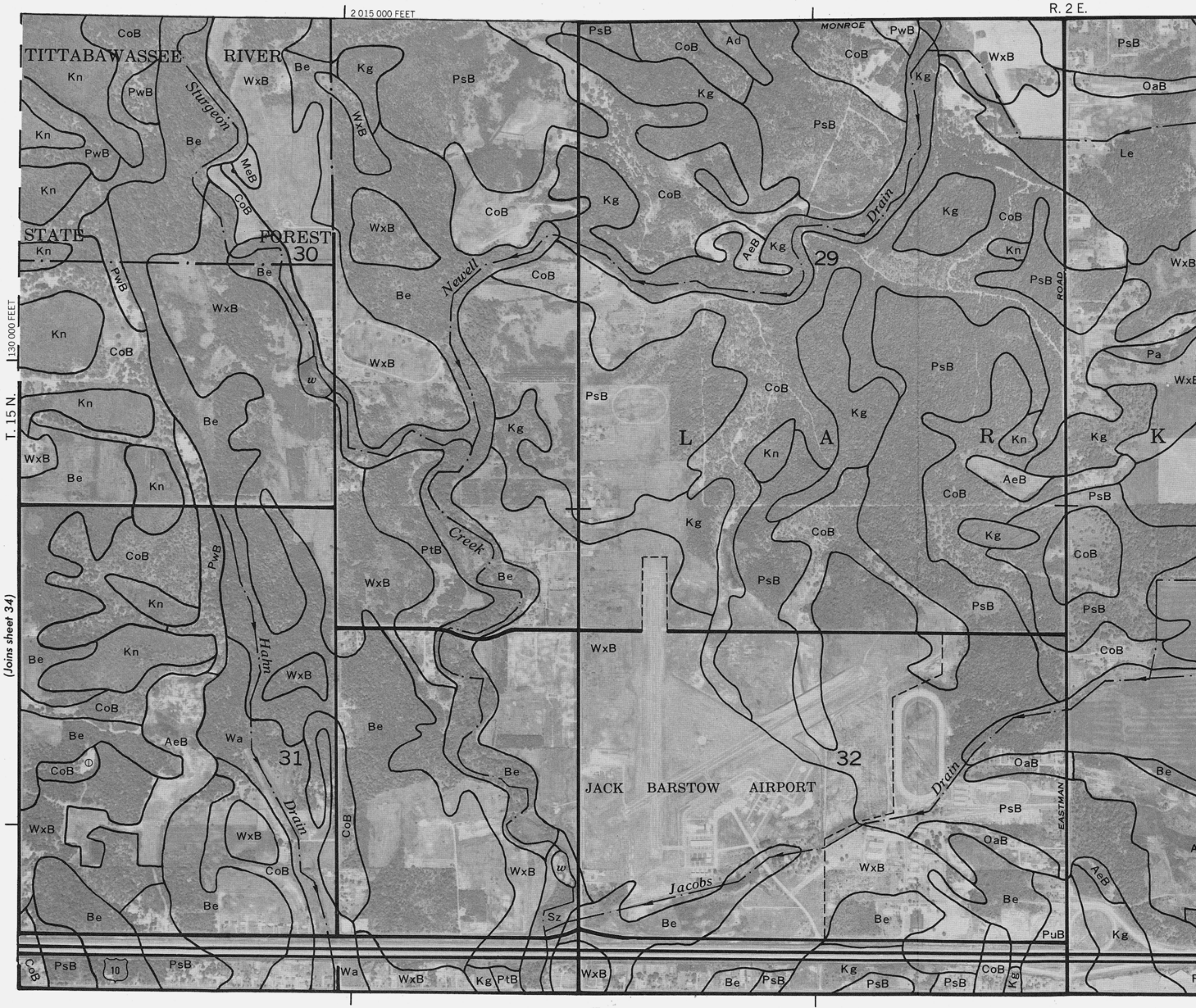
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 34


N
1 Mile
5 000 Feet
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
1
(Joins sheet 28)
(Joins sheet 33)
(sh 27)
(Joins sheet 35)
(sh 29)
(Joins sheet 40)
R. 1 E.
T. 15 N.
2 010 000 FEET
130 000 FEET
125 000 FEET
1 995 000 FEET
MONROE ROAD
HOPE ROAD
MERIDIAN
MICHIGAN
STARK
CHESAPEAKE AND OHIO
Averill Creek
Inman
Sterns Drain
Bench Drain
Drain
TITTABAWASSEE RIVER
TITTABAWASSEE RIVER STATE FOREST
Averill
LINCOLN
10
25
26
27
28
33
34
35
36

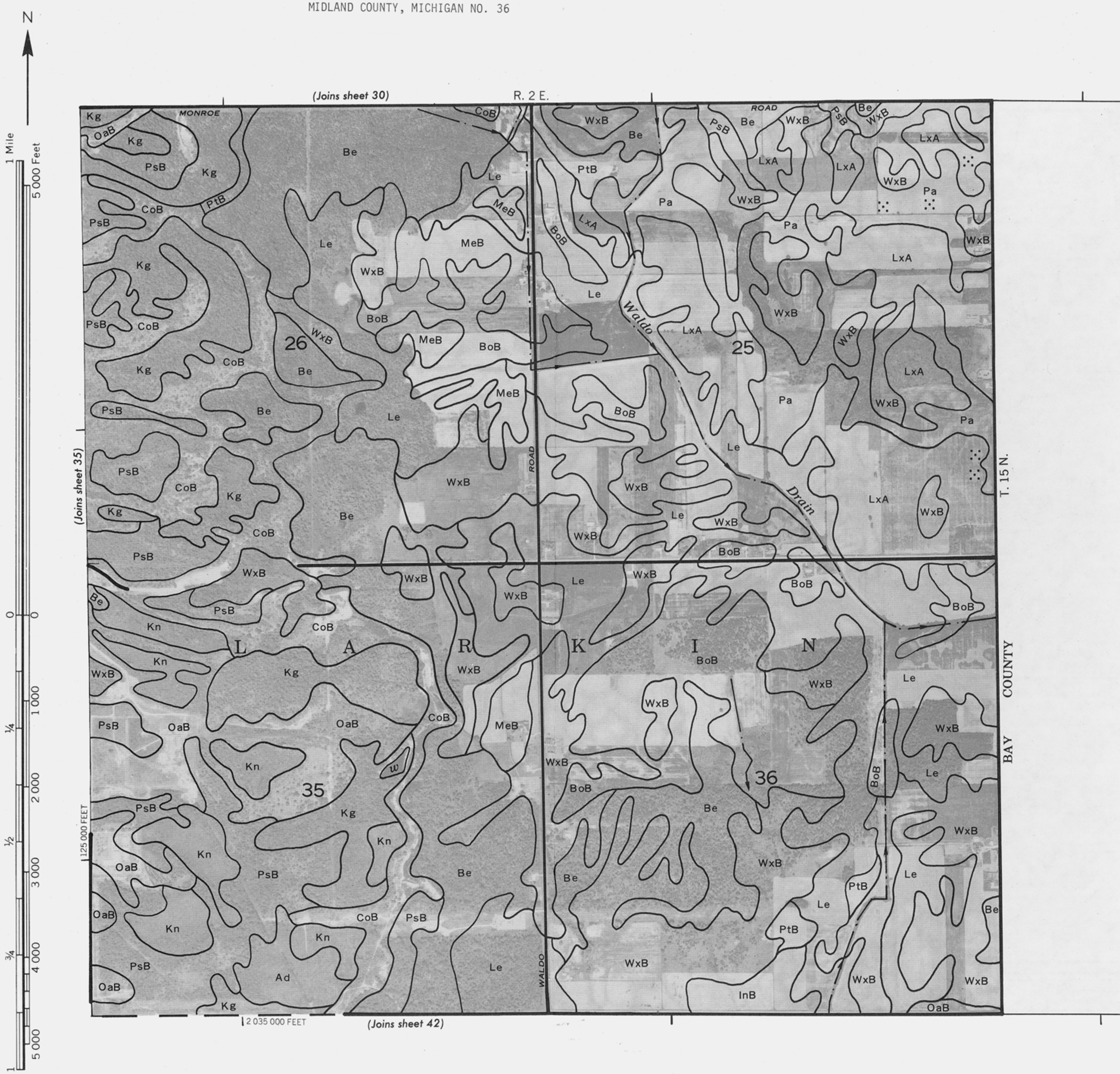
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

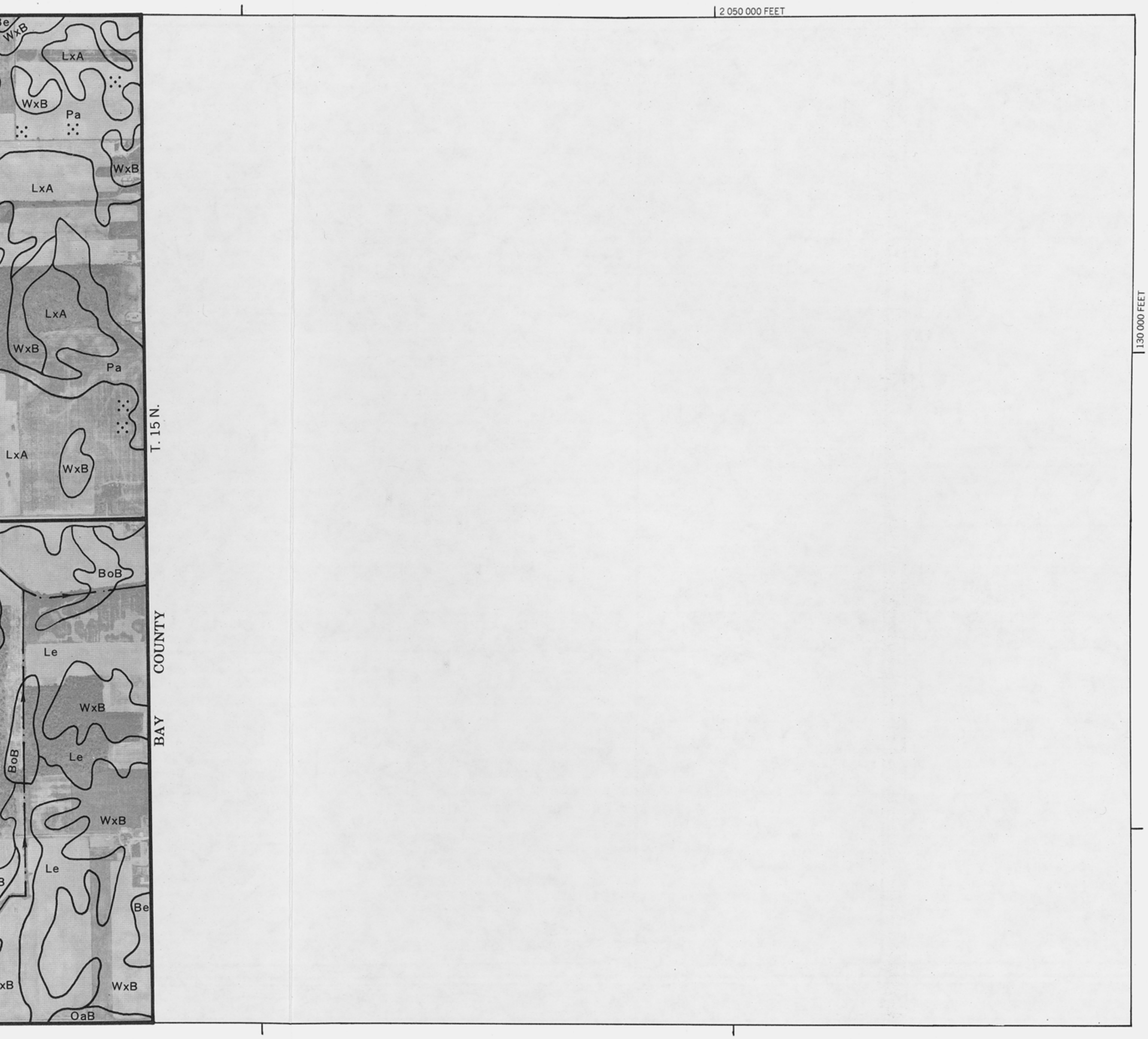

N
R. 2 E.
(Joins sheet 29)
ROAD
28
27
33
34
R
K
I
N
ROAD
EASTMAN
Drain
Sieberts
Drain
(Joins sheet 36)
125 000 FEET
2 030 000 FEET
(Joins sheet 41)
10
1 Mile
5 000 Feet
0
0
¼
1 000
2 000
½
3 000
¾
4 000
1
5 000
OaB
PsB
WxB
Le
Be
PtB
Kg
CoB
Kn
Pa
LrB
AeB
BoB
CsB
PuB


2 015 000 FEET
R. 2 E.
T. 15 N.
130 000 FEET
(Joins sheet 34)
TITTABAWASSEE RIVER
STATE FOREST
Sturgeon
Newell Creek
Hahn Drain
Drain
MONROE
ROAD
EASTMAN
Jacobs
JACK BARSTOW AIRPORT
L A R K
29
30
31
32
10
CoB
Kn
PwB
WxB
Be
MeB
Kg
PsB
Ad
OaB
Le
AeB
Pa
PtB
Wa
Sz
PuB
w

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

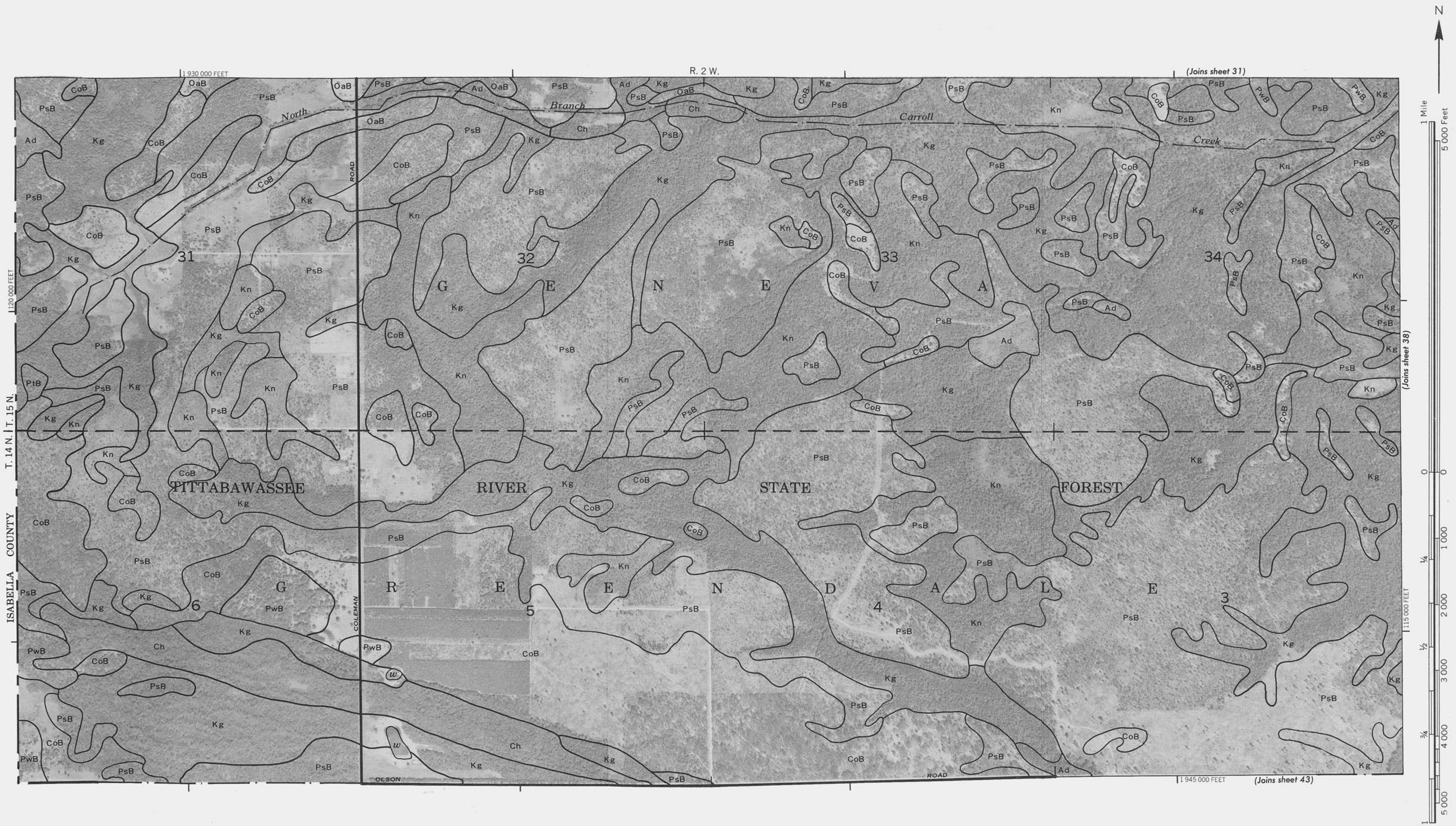
MIDLAND COUNTY, MICHIGAN NO. 36


N
1 Mile
5 000 Feet
0
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
1
(Joins sheet 30)
R. 2 E.
(Joins sheet 35)
(Joins sheet 42)
T. 15 N.
BAY COUNTY
MONROE
ROAD
ROAD
WALDO
Waldo Drain
125 000 FEET
2 035 000 FEET
L A R K I N
26
25
35
36
Kg
OaB
PsB
CoB
PtB
Be
Le
MeB
WxB
BoB
LxA
Pa
Kn
Ad
InB
w


2 050 000 FEET
130 000 FEET
Be
WxB
LxA
WxB
Pa
WxB
LxA
LxA
WxB
Pa
LxA
WxB
T. 15 N.
BoB
Le
WxB
BoB
Le
WxB
Le
Be
xB
WxB
OaB
BAY COUNTY

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 37

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

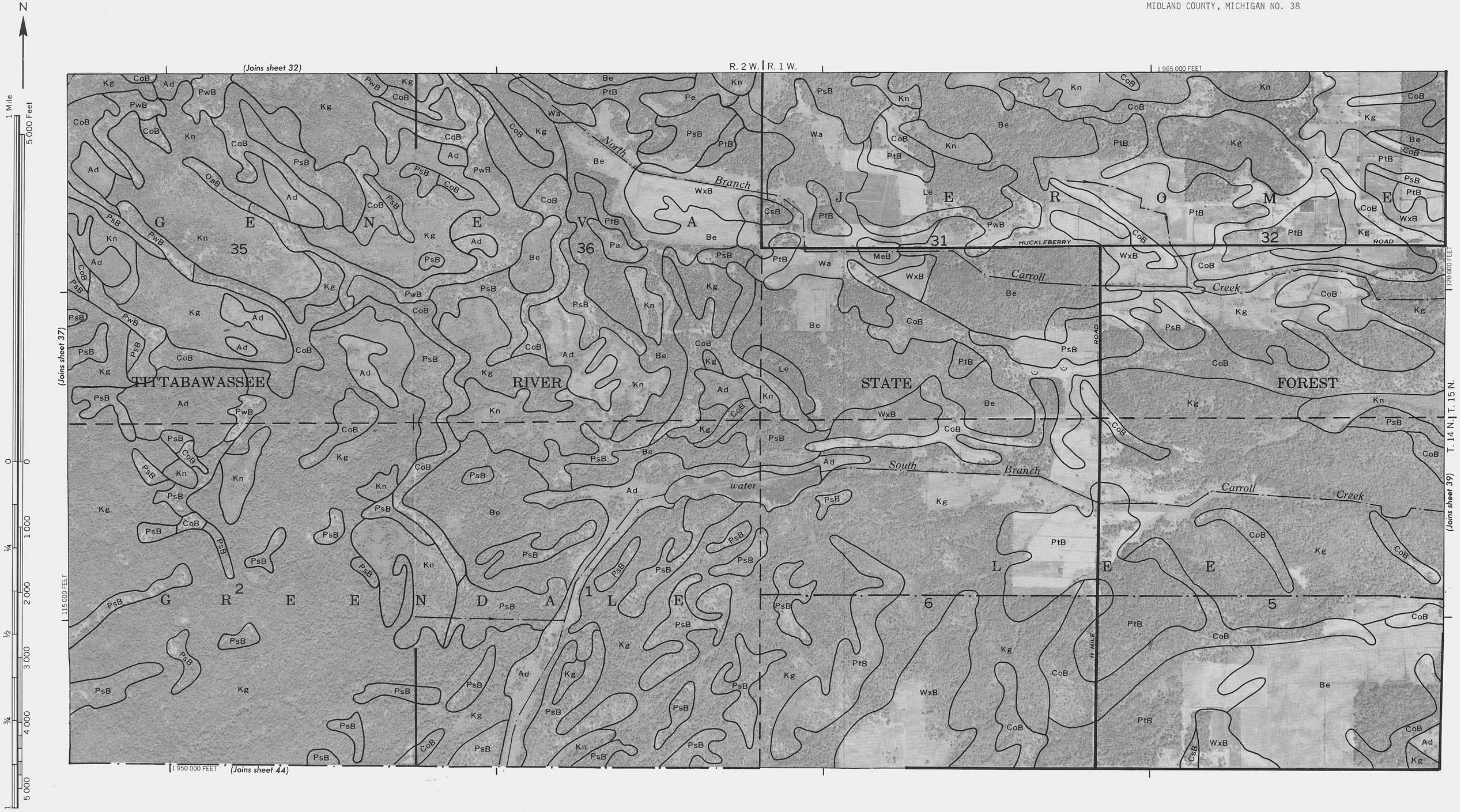

N
1 930 000 FEET
R. 2 W.
(Joins sheet 31)
(Joins sheet 38)
(Joins sheet 43)
1 945 000 FEET
120 000 FEET
115 000 FEET
T. 15 N.
T. 14 N.
ISABELLA COUNTY
North Branch
Carroll Creek
ROAD
COLEMAN
OLSON ROAD
31
32
33
34
6
5
4
3
GENEVA
GREENDALE
TITTABAWASSEE RIVER STATE FOREST
PsB
CoB
Kg
Kn
OaB
Ad
Ch
PwB
PtB
w
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

38

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 38

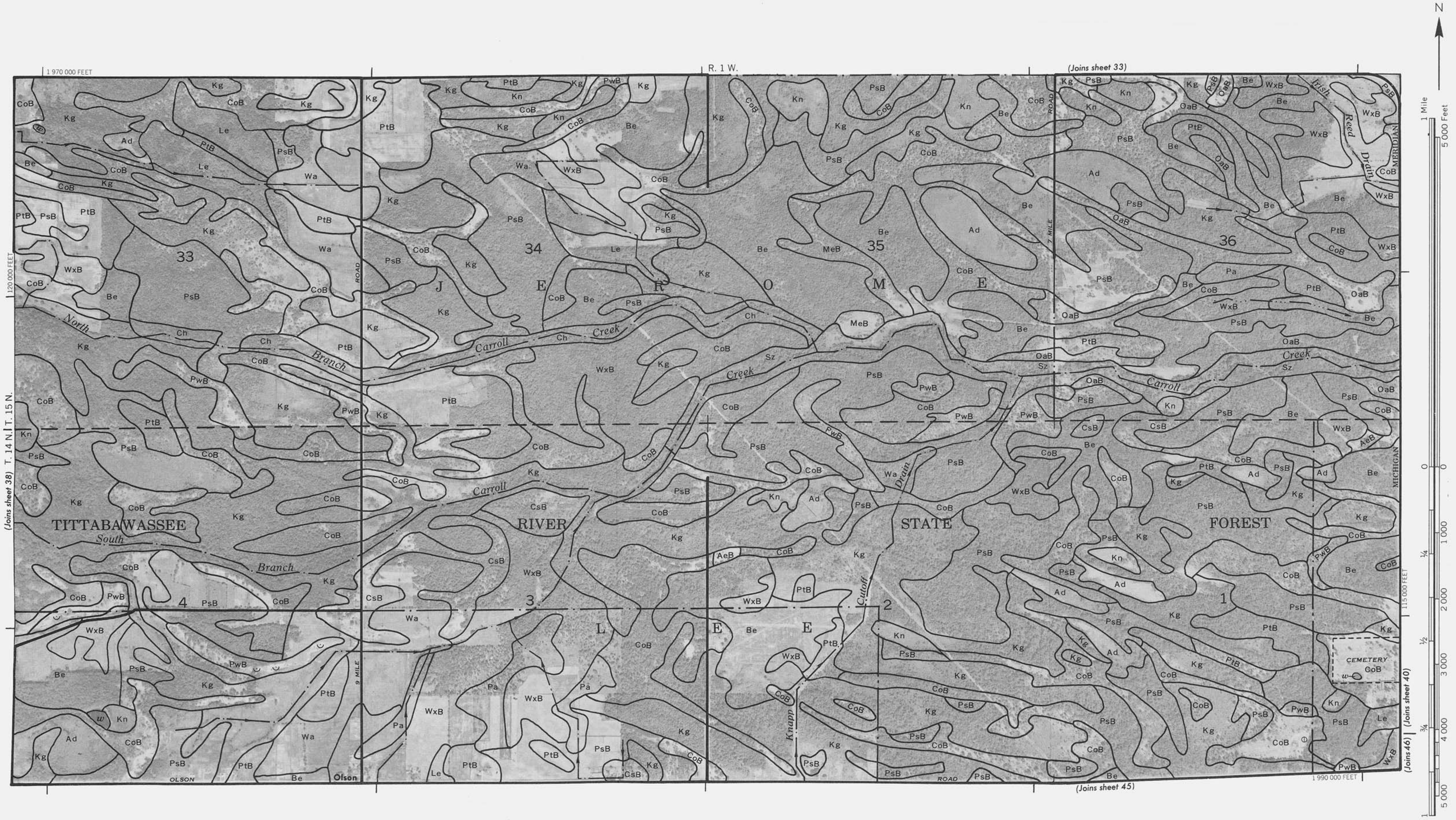
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 38


N
1 Mile
5 000 Feet
0
0
1/4
1 000
2 000
1/2
3 000
3/4
4 000
1
5 000
(Joins sheet 32)
R. 2 W. | R. 1 W.
1 965 000 FEET
(Joins sheet 37)
(Joins sheet 39)
120 000 FEET
115 000 FEET
T. 15 N. | T. 14 N.
1 950 000 FEET
(Joins sheet 44)
TITTABAWASSEE RIVER STATE FOREST
GENEVA
JEROME
GREENDALE
LEE
35
36
31
32
2
1
6
5
North Branch
South Branch
Carroll Creek
Carroll Creek
water
HUCKLEBERRY ROAD
ROAD
11 MILE
Ad
Be
CoB
CsB
Kg
Kn
Le
MeB
OaB
Pa
Pe
PsB
PtB
PwB
Wa
WxB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 39

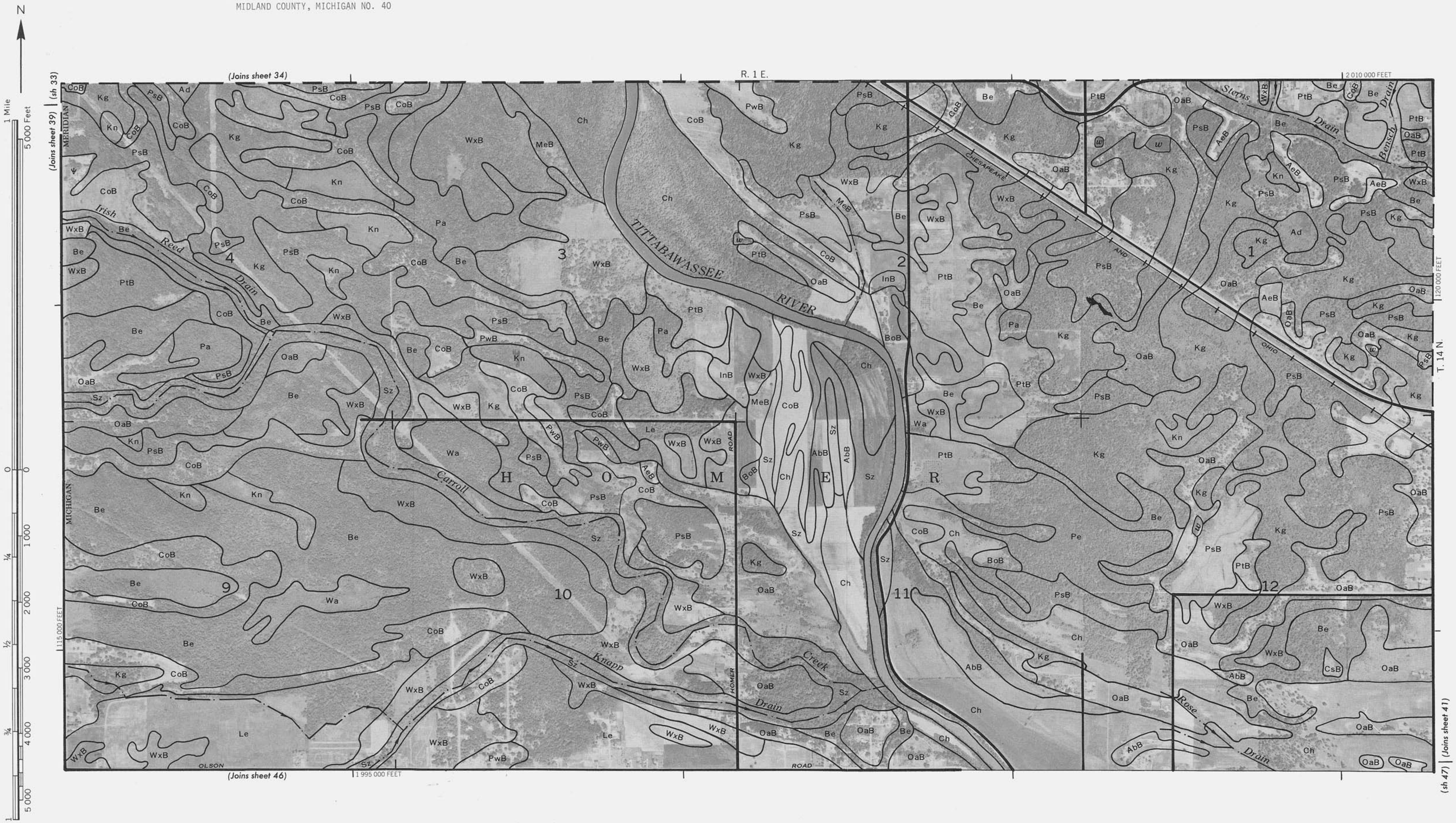
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 970 000 FEET
R. 1 W.
(Joins sheet 33)
120 000 FEET
T. 14 N. | T. 15 N.
(Joins sheet 38)
33
34
35
36
JEROME
TITTABAWASSEE RIVER STATE FOREST
LEE
4
3
2
1
North Branch
South Branch
Carroll Creek
Wa Drain
Cutoff
Irish Reed Drain
ROAD
7 MILE ROAD
9 MILE
Knapp
OLSON
Olson
ROAD
MERIDIAN
MICHIGAN
CEMETERY
115 000 FEET
1 990 000 FEET
(Joins sheet 45)
(Joins 46)
(Joins sheet 40)
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5 000
¼
½
¾
1
Kg
CoB
PsB
Be
PtB
Le
Ad
Wa
WxB
Ch
PwB
Kn
Sz
MeB
OaB
CsB
AeB
Pa
CsB
PtE
w

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 40

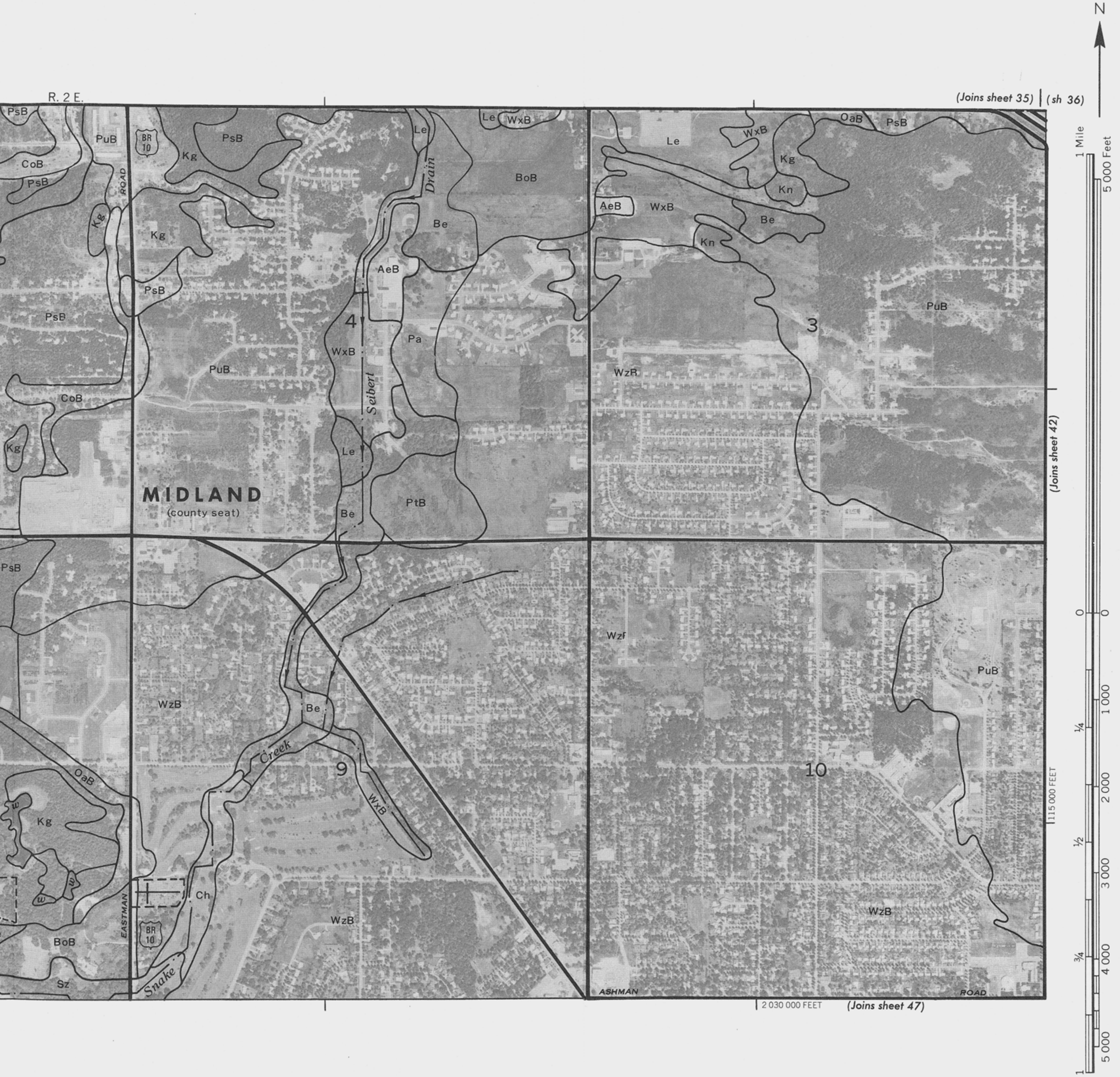
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

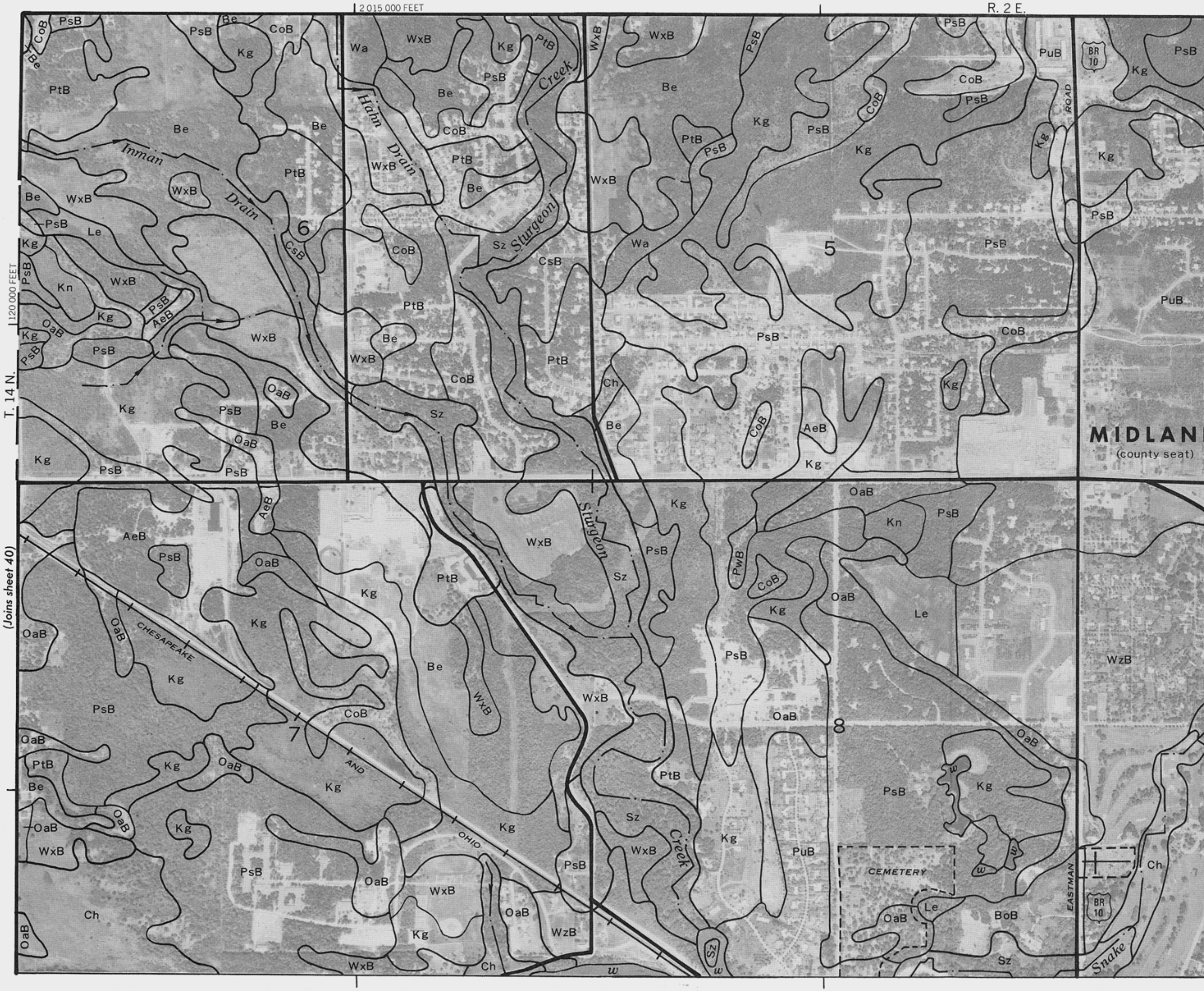
MIDLAND COUNTY, MICHIGAN NO. 40


N
1 Mile
5 000 Feet
0
1 000
1/4
2 000
1/2
3 000
3/4
4 000
5 000
1
(Joins sheet 34)
R. 1 E.
2 010 000 FEET
(Joins sheet 39)
(sh 33)
MERIDIAN
MICHIGAN
115 000 FEET
120 000 FEET
T. 14 N.
(Joins sheet 46)
1 995 000 FEET
(Joins sheet 41)
(sh 47)
OLSON
ROAD
HOMER
ROAD
TITTABAWASSEE
RIVER
CHESAPEAKE
AND
OHIO
Irish
Reed
Drain
Carroll
Knapp
Creek
Drain
Rose
Drain
Sterns
Drain
Bensch
Drain
H O M E R
1
2
3
4
9
10
11
12
CoB
Kg
PsB
Ad
CoB
PsB
CoB
Kn
CoB
Kg
PsB
CoB
Kn
Ch
WxB
MeB
Pa
Kn
CoB
WxB
Be
Be
WxB
PtB
CoB
Be
Pa
OaB
PsB
OaB
Sz
Be
WxB
Sz
Be
OaB
Kn
PsB
CoB
Kn
Kn
Be
WxB
Be
CoB
Be
CoB
9
Wa
Be
Kg
CoB
Le
WxB
Kg
Kn
PsB
CoB
Be
Be
CoB
PsB
PwB
Kn
CoB
WxB
Kg
PsB
CoB
Wa
PsB
PwB
PwB
Le
AeB
CoB
PsB
CoB
WxB
WxB
Sz
WxB
CoB
WxB
WxB
PsB
Kg
OaB
WxB
Sz
WxB
WxB
Le
WxB
WxB
PwB
CoB
Ch
PtB
Pa
WxB
Be
InB
WxB
MeB
CoB
PwB
Kg
WxB
MeB
PsB
CoB
OaB
PtB
Be
InB
BoB
Ch
Sz
AbB
AbB
Ch
Sz
Sz
Sz
Ch
OaB
OaB
Sz
Be
OaB
Be
Ch
OaB
PsB
Kg
Be
PtB
WxB
Be
OaB
Pa
PtB
Be
WxB
Wa
PtB
CoB
Ch
BoB
PsB
Ch
Kg
AbB
Ch
Kg
WxB
OaB
PsB
Kg
OaB
Kg
PsB
Pe
Kg
Be
Kn
OaB
Kg
PsB
PtB
OaB
WxB
Be
OaB
AbB
Be
OaB
Ch
AbB
OaB
OaB
CsB
PtB
OaB
PsB
AeB
Kn
AeB
Kg
PsB
Ad
Kg
OaB
AeB
OaB
PsB
Kg
PsB
OaB
Kg
PsB
AeB
WxB
Be
Kg
Be
PtB
OaB
PtB
CoB
Be
WxB
PtB
Be
OaB
Kg
PsB
Kg
OaB
OaB
PsB
Kg
w
w
w
w
w

COUNTY, MICHIGAN — SHEET NUMBER 41

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

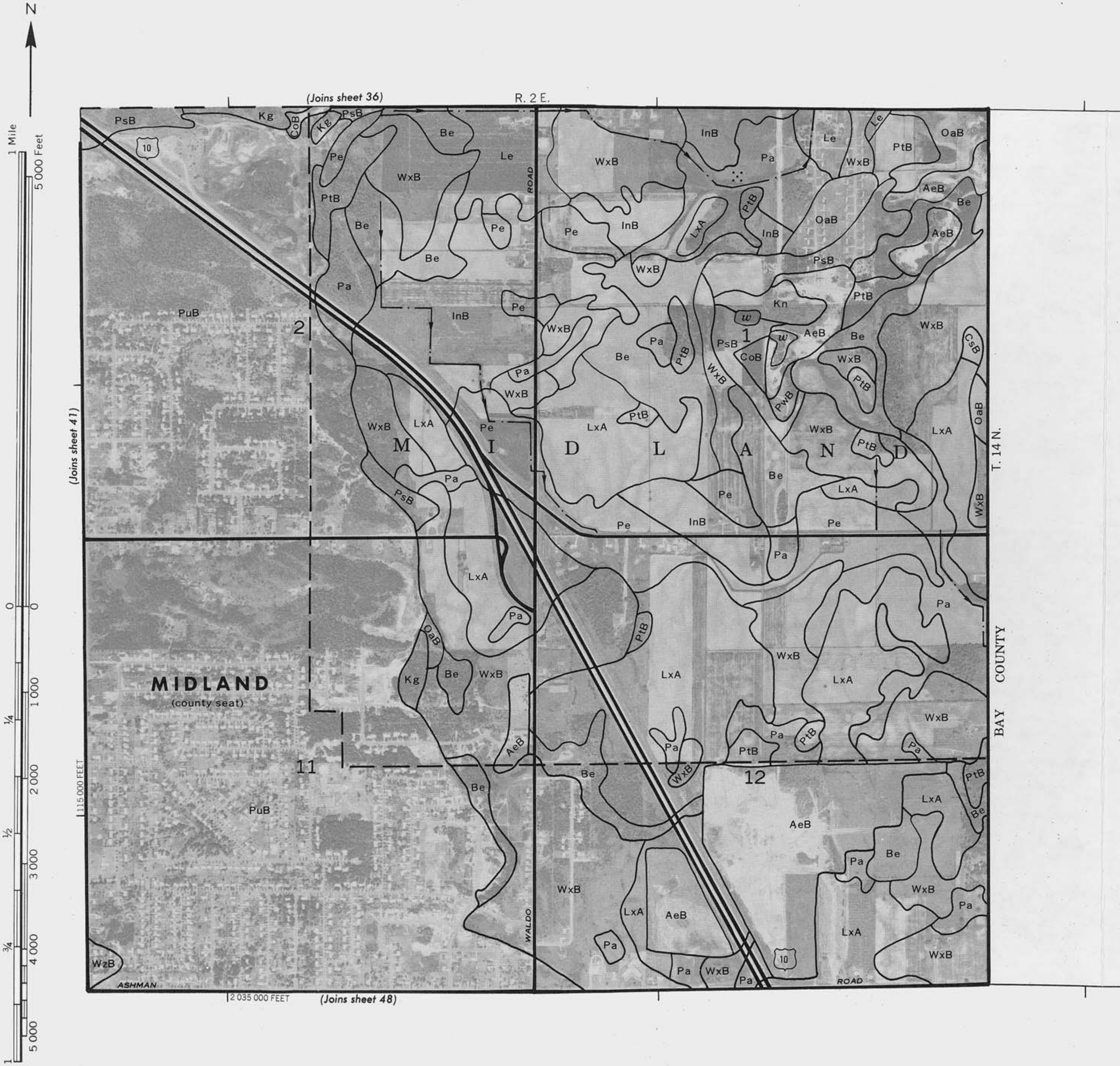

N
R. 2 E.
(Joins sheet 35)
(sh 36)
(Joins sheet 42)
(Joins sheet 47)
115 000 FEET
2 030 000 FEET
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
MIDLAND
(county seat)
ROAD
EASTMAN
ASHMAN
ROAD
BR 10
Drain
Seibert
Creek
Snake
4
3
9
10
PsB
PuB
CoB
Kg
PsB
Le
WxB
OaB
BoB
Be
AeB
Kn
Pa
WzB
Le
PtB
Be
Ch
Sz
w
WzB
PuB

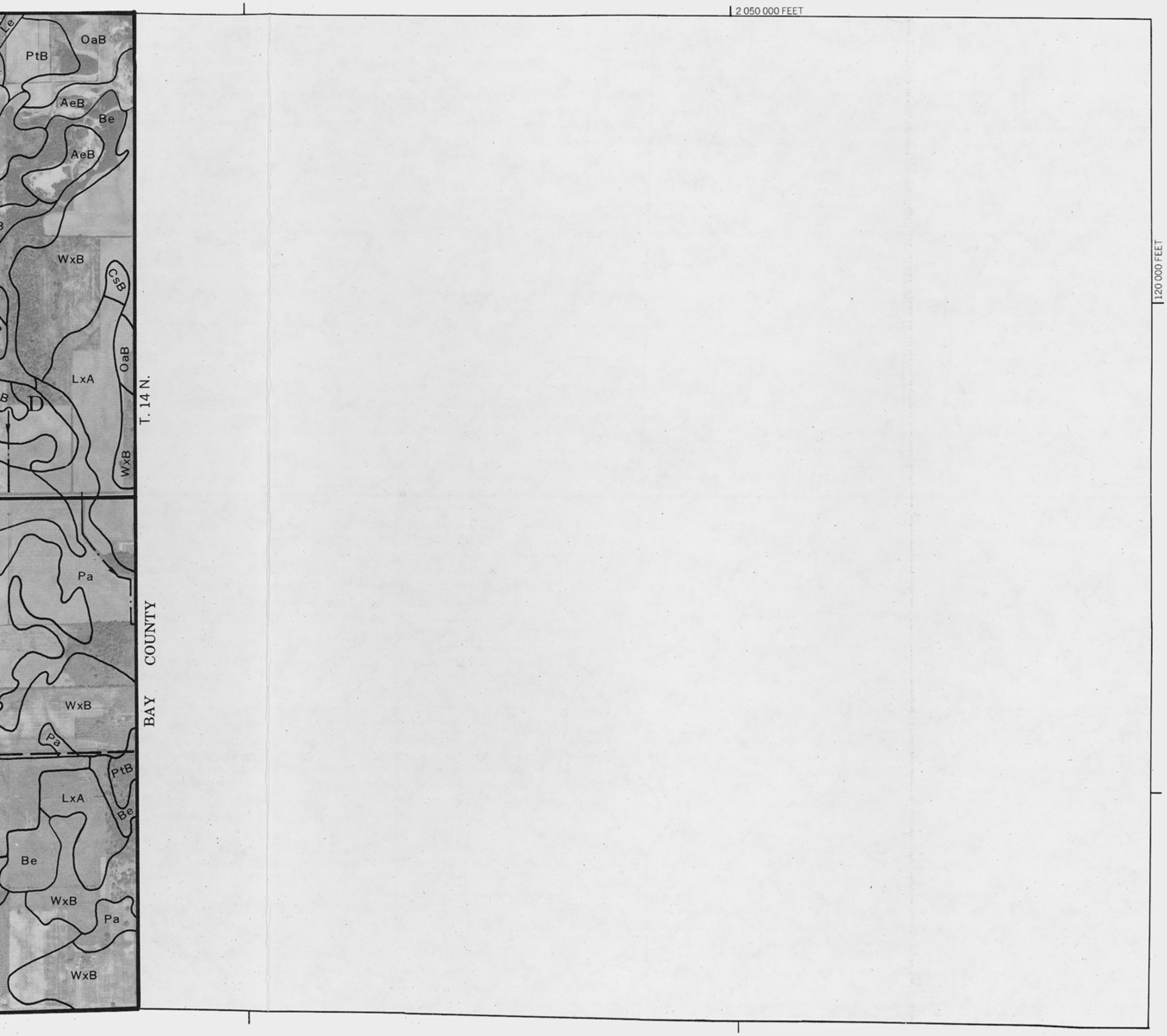

2 015 000 FEET
R. 2 E.
120 000 FEET
T. 14 N.
(Joins sheet 40)
6
5
7
8
Inman Drain
Hahn Drain
Sturgeon Creek
Sturgeon Creek
CHESAPEAKE AND OHIO
ROAD
EASTMAN
BR 10
BR 10
CEMETERY
Snake
MIDLAN
(county seat)
CoB
PsB
Be
PtB
Kg
WxB
Wa
Le
Kn
AeB
OaB
CsB
CsB
Sz
Ch
PuB
WzB
PwB
BoB
w

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 42

MIDLAND COUNTY, MICHIGAN — SHEET N


N
1 Mile
5 000 Feet
0
0
1 000
¼
2 000
½
3 000
¾
4 000
1
5 000
(Joins sheet 36)
R. 2 E.
(Joins sheet 41)
(Joins sheet 48)
T. 14 N.
BAY COUNTY
115 000 FEET
2 035 000 FEET
MIDLAND
(county seat)
M I D L A N D
ROAD
WALDO
ASHMAN
ROAD
10
10
2
1
11
12
PsB
Kg
CoB
Kg
PsB
Be
Le
Pe
WxB
PtB
Be
Pe
Be
Pa
PuB
InB
Pe
WxB
Pa
WxB
LxA
Pe
Pa
PsB
LxA
Pa
OaB
Kg
Be
WxB
AeB
Be
PuB
WzB
WxB
InB
Pa
Le
PtB
OaB
WxB
Pe
InB
LxA
PtB
InB
OaB
AeB
Be
AeB
WxB
PsB
Kn
PtB
w
w
AeB
Be
WxB
Pa
PtB
PsB
CoB
WxB
PtB
Be
CsB
WxB
PtB
PwB
LxA
PtB
WxB
PtB
OaB
LxA
Be
LxA
Pe
InB
Pe
Pe
WxB
Pa
Pa
PtB
LxA
WxB
LxA
WxB
Pa
PtB
Pa
PtB
Pa
Pa
WxB
Be
PtB
LxA
Be
AeB
Pa
Be
WxB
Pa
WxB
LxA
AeB
Pa
WxB
LxA
Pa
WxB
Pa

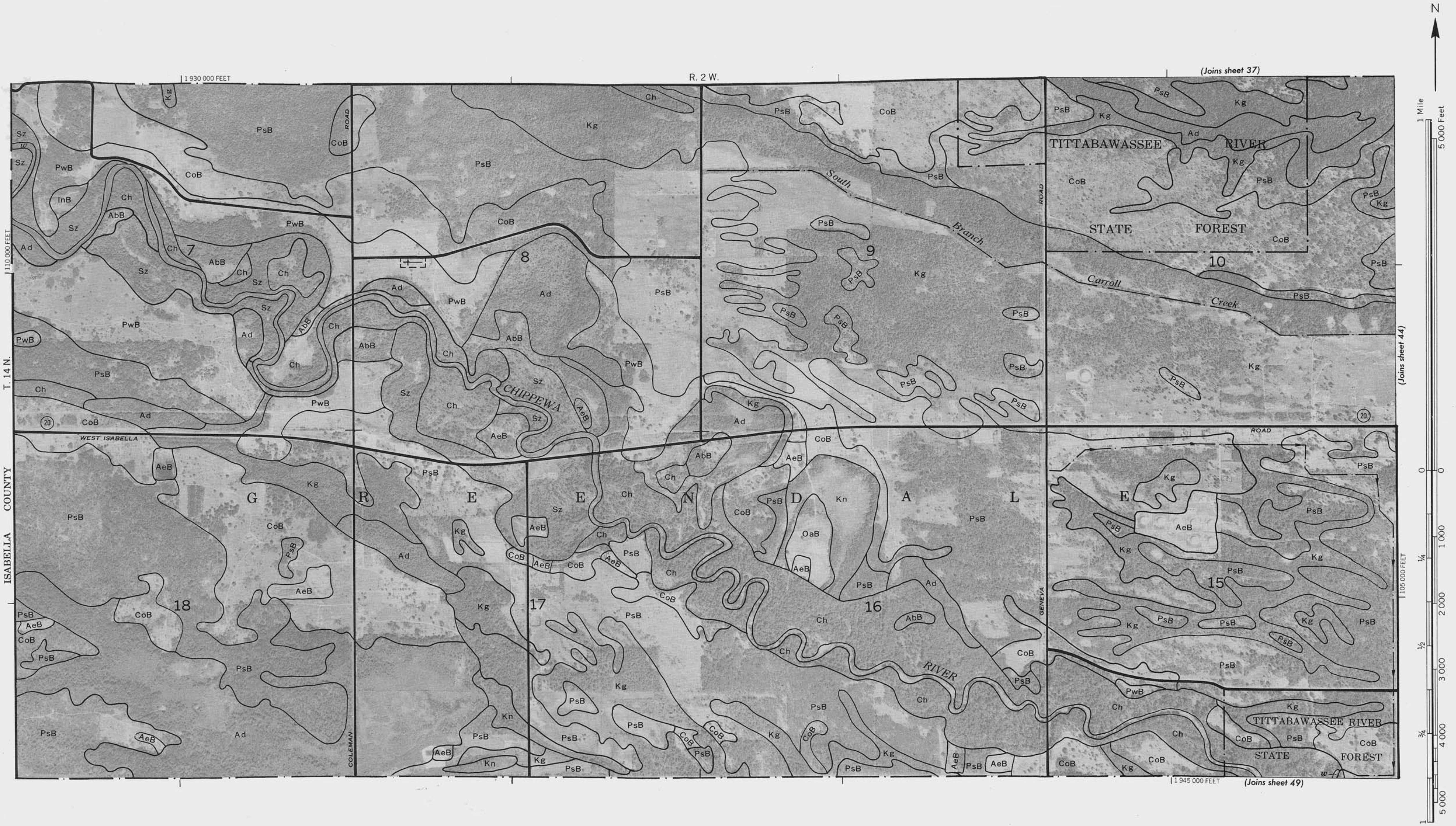

2 050 000 FEET
120 000 FEET
OaB
PtB
Le
AeB
Be
AeB
WxB
CsB
OaB
LxA
D
T. 14 N.
WxB
Pa
BAY COUNTY
WxB
Pa
PtB
LxA
Be
Be
WxB
Pa
WxB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 43

MIDLAND COUNTY, MICHIGAN NO. 43

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

43

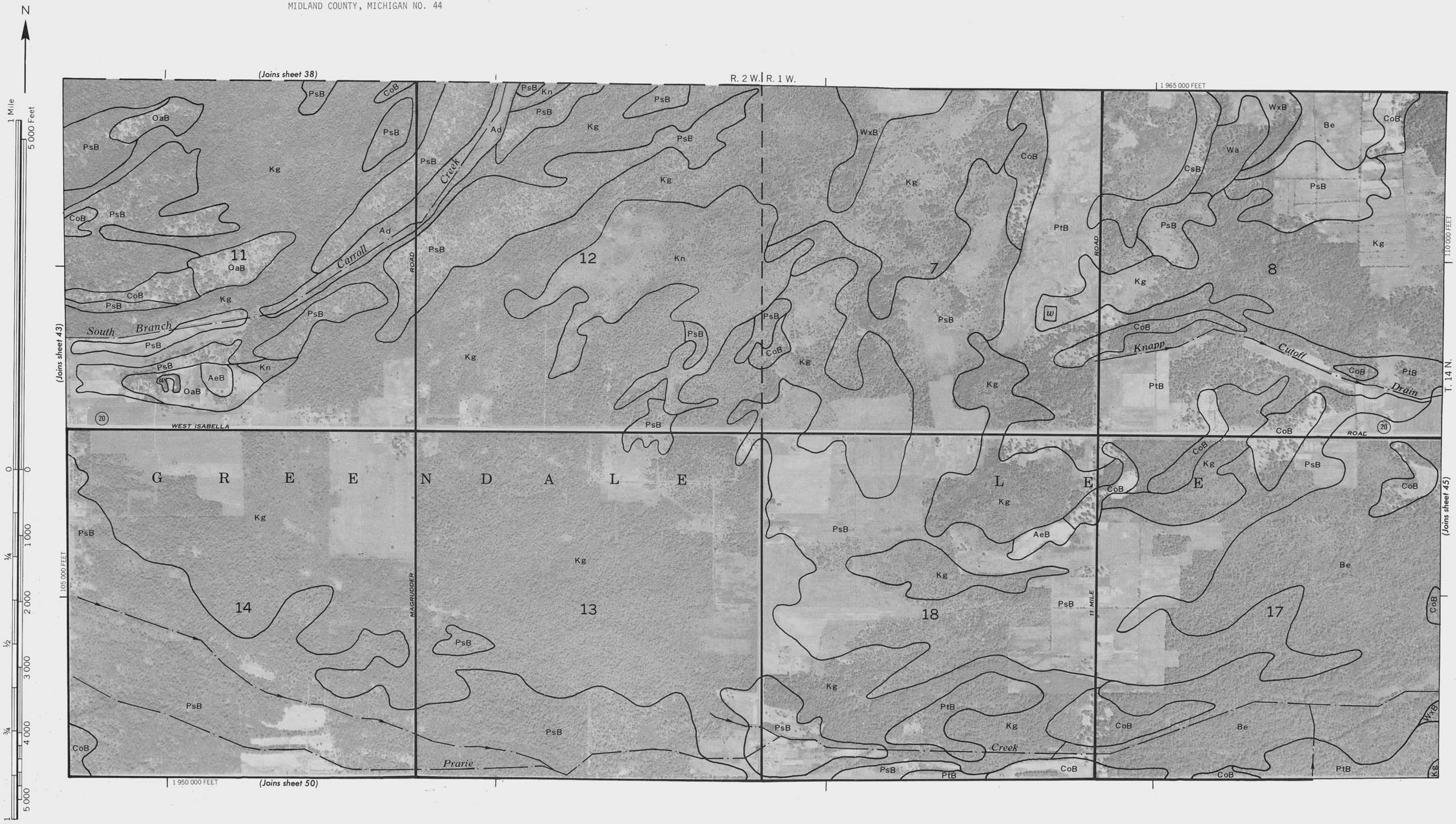

N
R. 2 W.
1 930 000 FEET
(Joins sheet 37)
(Joins sheet 44)
(Joins sheet 49)
1 945 000 FEET
110 000 FEET
105 000 FEET
T. 14 N.
ISABELLA COUNTY
WEST ISABELLA
ROAD
COLEMAN
GENEVA
20
TITTABAWASSEE RIVER
STATE FOREST
South Branch
Carroll Creek
CHIPPEWA
RIVER
G R E E N D A L E
7
8
9
10
15
16
17
18
Sz
PwB
InB
Ch
AbB
Ad
PsB
CoB
Kg
AbB
Sz
AeB
Kn
OaB
w
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1 000
2 000
3 000
4 000
5 000

44

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 44

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

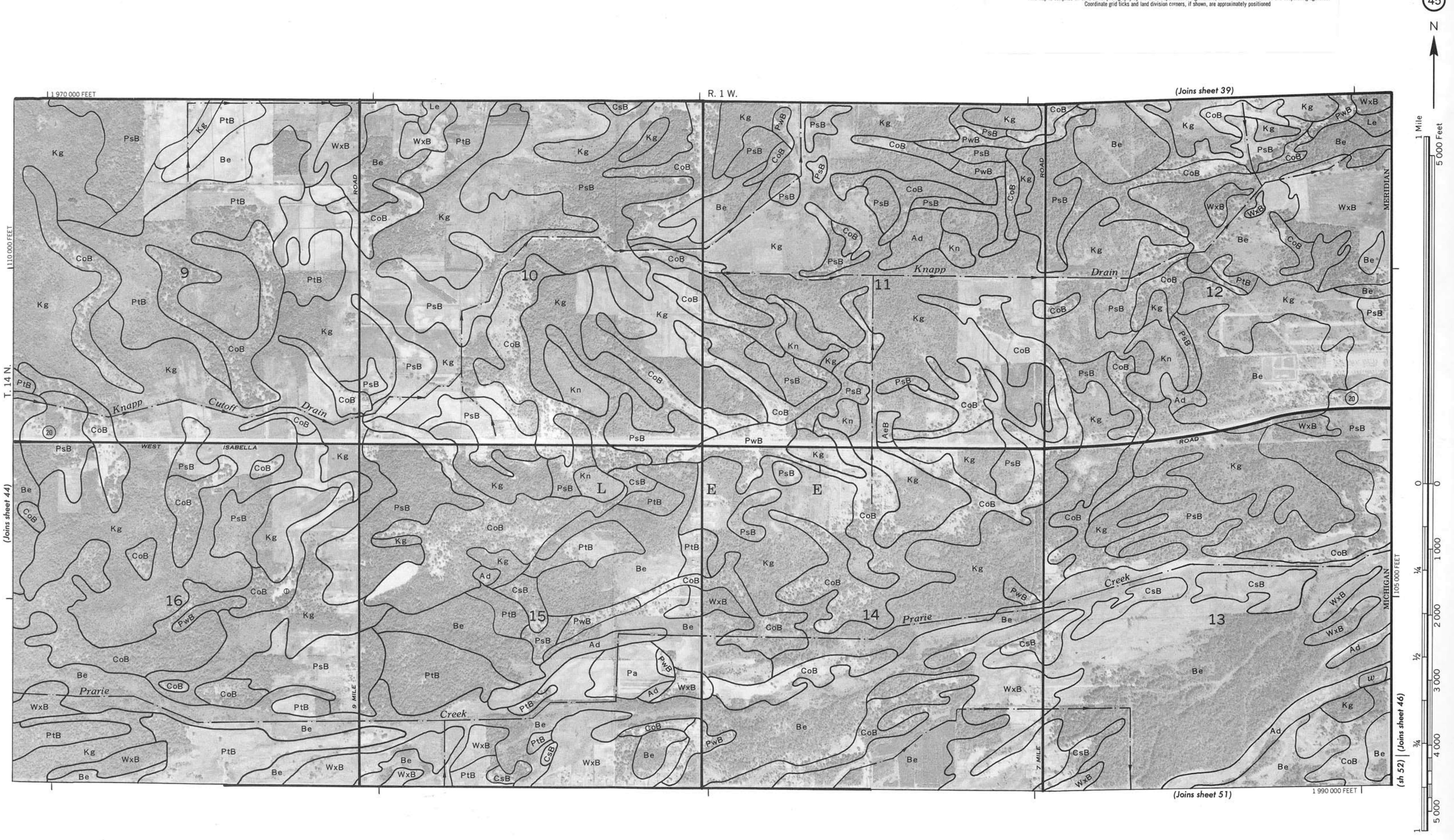
MIDLAND COUNTY, MICHIGAN NO. 44


N
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000
(Joins sheet 38)
R. 2 W.
R. 1 W.
1 965 000 FEET
110 000 FEET
T. 14 N.
(Joins sheet 43)
(Joins sheet 45)
105 000 FEET
1 950 000 FEET
(Joins sheet 50)
11
12
7
8
14
13
18
17
G R E E N D A L E
Carroll Creek
South Branch
Knapp Cutoff Drain
Prarie Creek
WEST ISABELLA
ROAD
MAGRUDDER
11 MILE
20
PsB
PsE
Kg
Kn
Kb
OaB
CoB
CsB
Ad
AeB
WxB
Wa
Be
PtB
w

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 45

MIDLAND COUNTY, MICHIGAN NO. 45

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

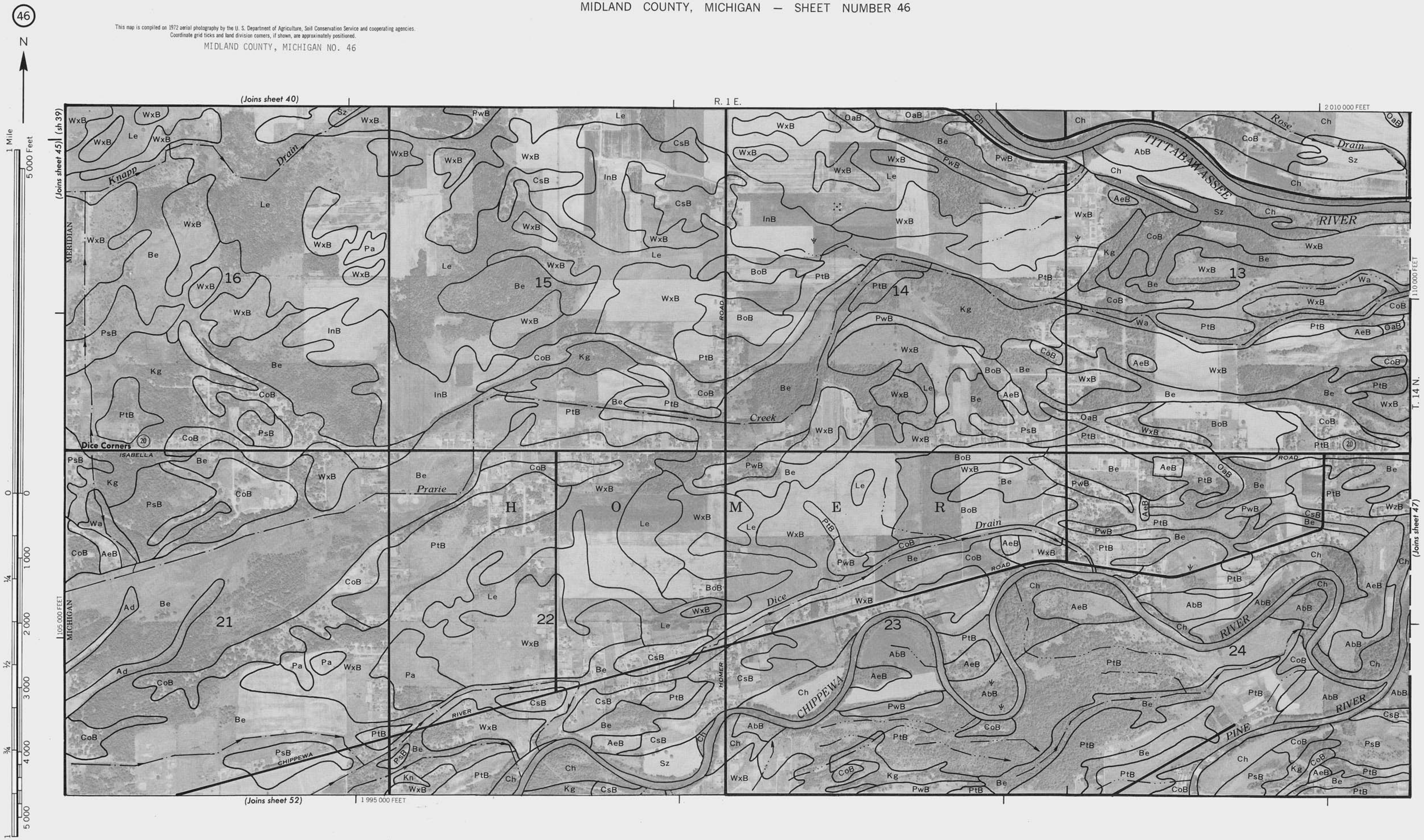


45
N
(Joins sheet 39)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 51)
(sh 52)
1 970 000 FEET
1 990 000 FEET
110 000 FEET
105 000 FEET
R. 1 W.
T. 14 N.
9
10
11
12
13
14
15
16
L
E
E
Knapp Cutoff Drain
Knapp Drain
Prarie Creek
WEST ISABELLA ROAD
ROAD
9 MILE
7 MILE
MERIDIAN
MICHIGAN
20
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
Kg
PsB
PtB
Be
CoB
CsB
WxB
PwB
Kn
Ad
Le
AeB
Pa
w

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 46

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

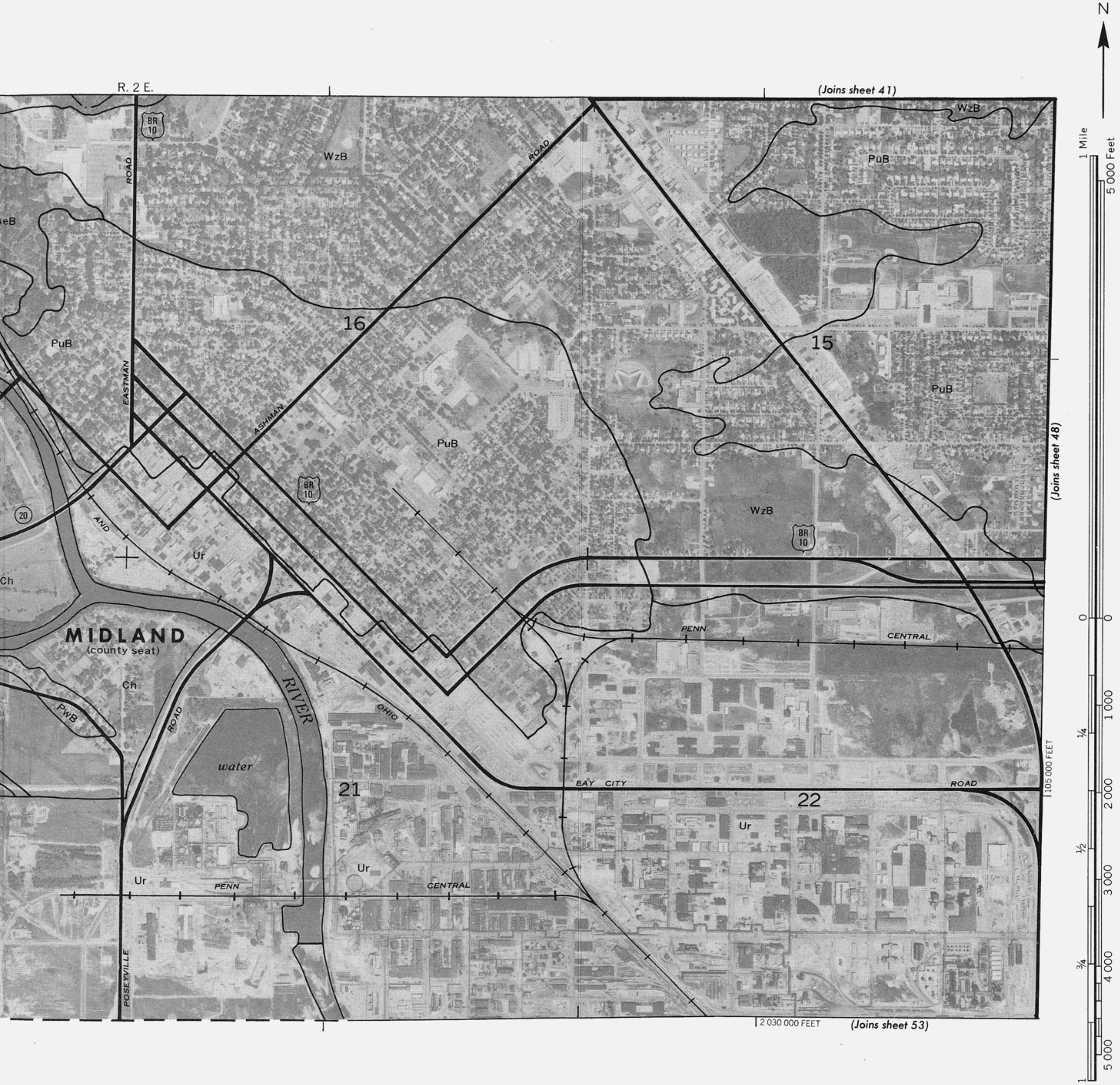
MIDLAND COUNTY, MICHIGAN NO. 46

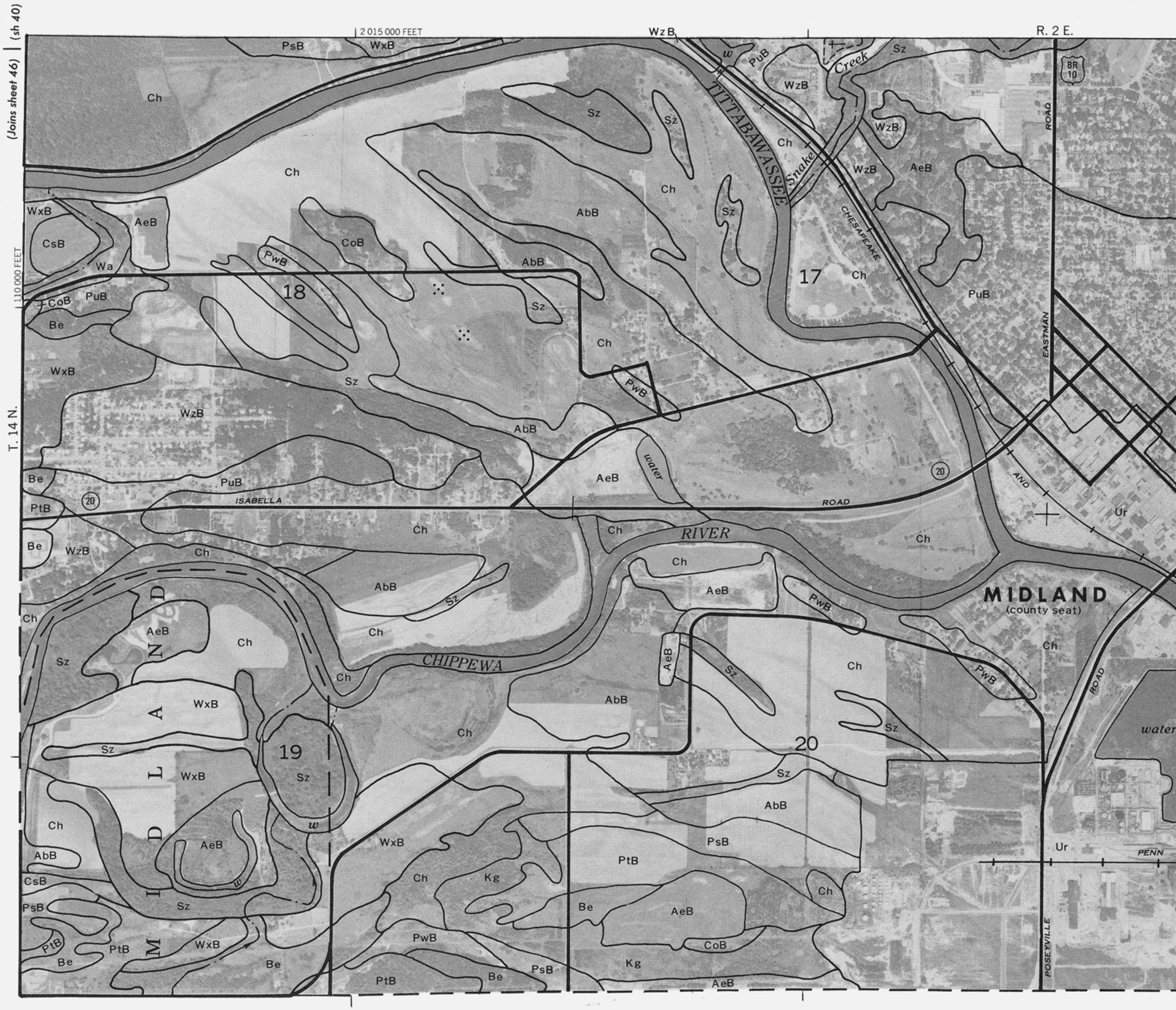


46
N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
(Joins sheet 40)
(Joins sheet 52)
(Joins sheet 45) (sh 39)
(Joins sheet 47)
R. 1 E.
T. 14 N.
2 010 000 FEET
110 000 FEET
105 000 FEET
1 995 000 FEET
MERIDIAN
MICHIGAN
ISABELLA
ROAD
HOMER
Dice Corners
20
Knapp
Drain
Creek
Prarie
Dice
Rose
TITTABAWASSEE
RIVER
CHIPPEWA
PINE
H O M E R
16
15
14
13
21
22
23
24

COUNTY, MICHIGAN — SHEET NUMBER 47

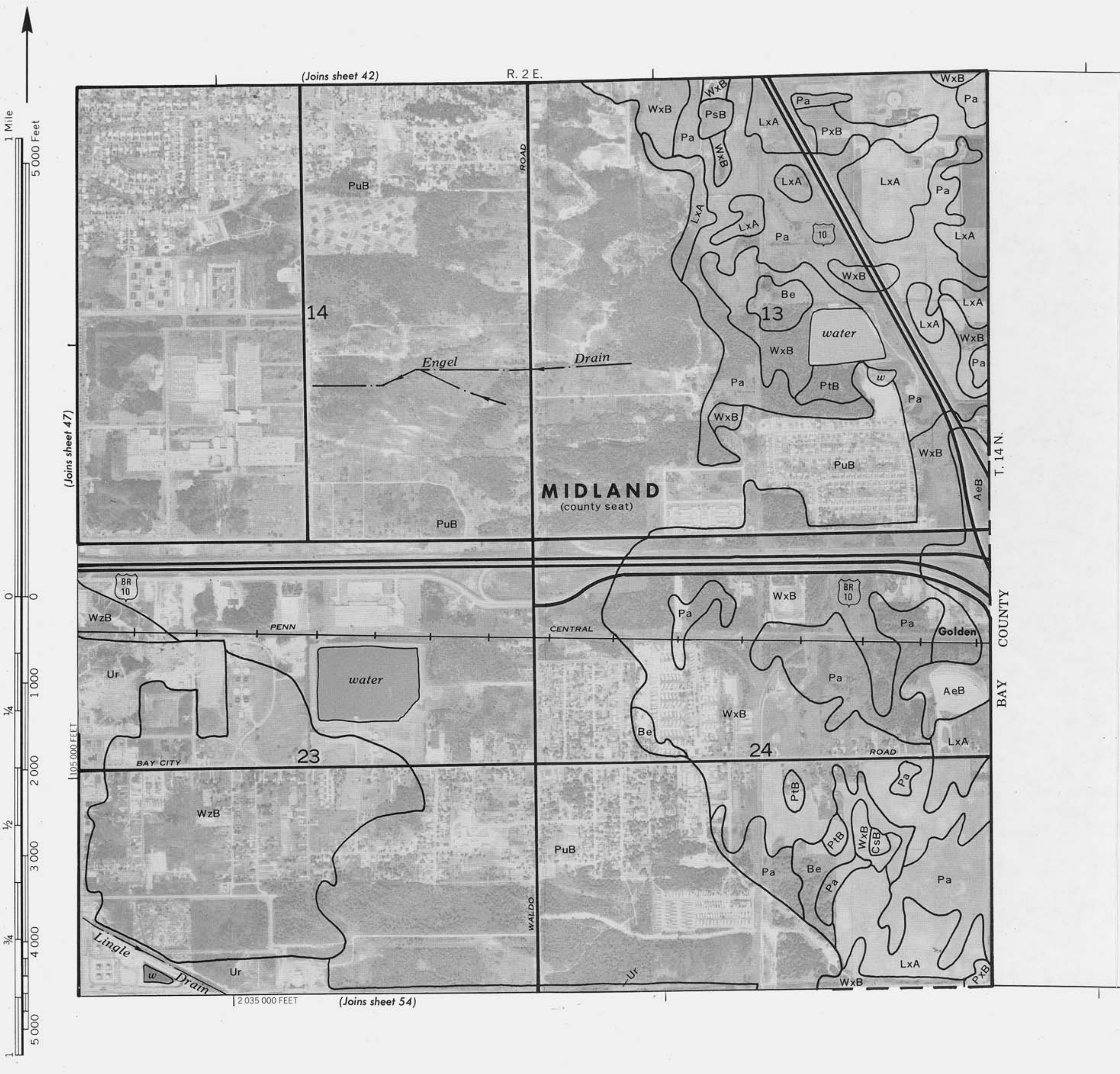
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

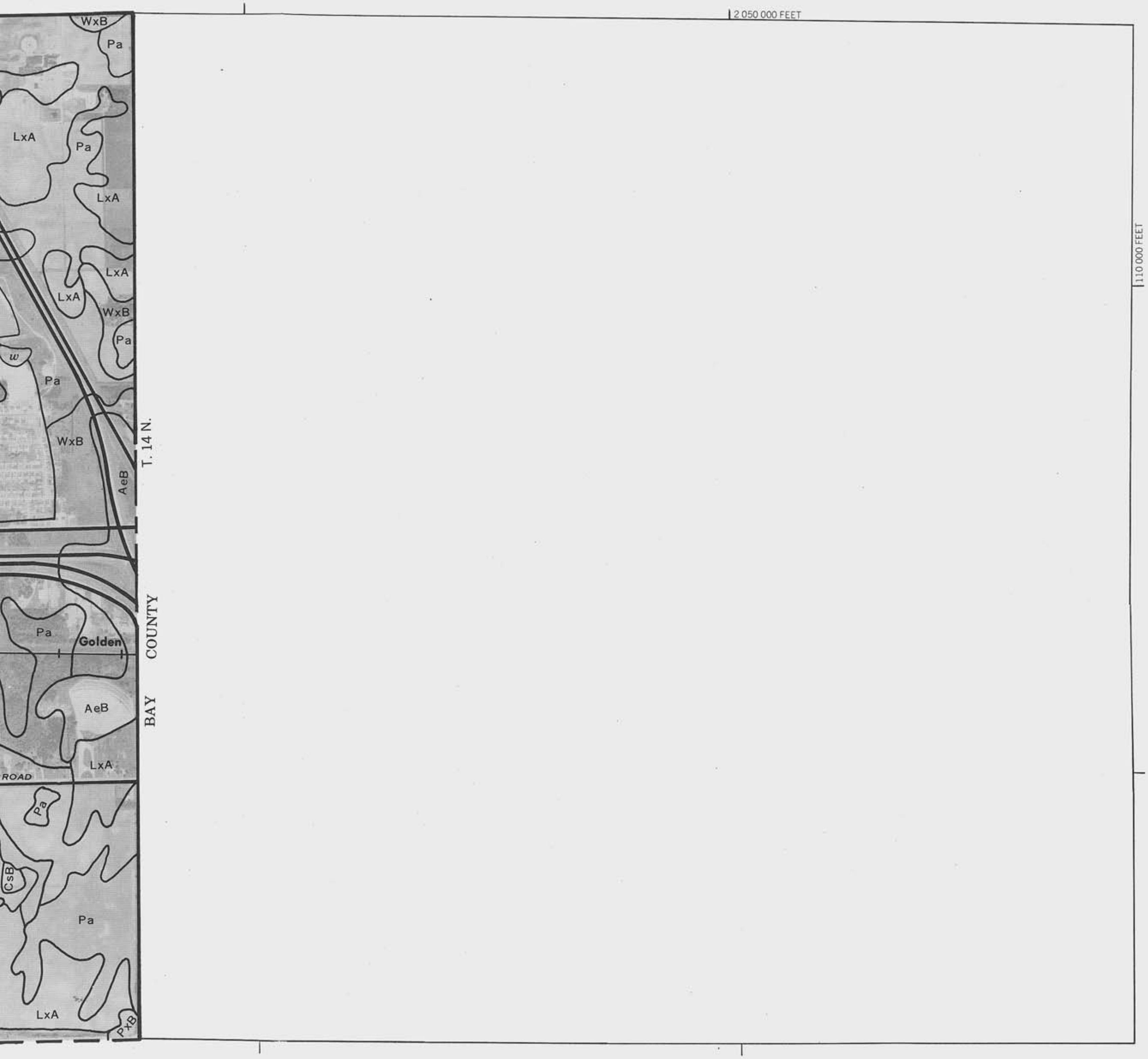

N
R. 2 E.
(Joins sheet 41)
(Joins sheet 48)
(Joins sheet 53)
WzB
PuB
eB
Ch
PwB
Ur
water
RIVER
MIDLAND
(county seat)
16
15
21
22
BR 10
20
ROAD
EASTMAN
ASHMAN
AND
OHIO
PENN
CENTRAL
BAY CITY
POSEYVILLE
105 000 FEET
2 030 000 FEET
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5 000


(Joins sheet 46)
(sh 40)
2 015 000 FEET
WzB
R. 2 E.
110 000 FEET
T. 14 N.
PsB
WxB
Ch
Sz
Sz
w
PuB
Creek
Sz
BR 10
WzB
WzB
TITTABAWASSEE
Ch
Snake
WzB
AeB
ROAD
Ch
Ch
AbB
Sz
CHESAPEAKE
WxB
AeB
CsB
CoB
Wa
PwB
AbB
17
Ch
PuB
18
CoB
PuB
Sz
Be
Ch
EASTMAN
WxB
PwB
Sz
WzB
AbB
water
AeB
20
AND
Be
PuB
ISABELLA
ROAD
PtB
20
Ur
Ch
Ch
Be
WzB
Ch
RIVER
Ch
Ch
AbB
Sz
AeB
PwB
MIDLAND
(county seat)
Ch
D
N
A
L
D
I
M
AeB
Ch
Ch
Sz
CHIPPEWA
Ch
AeB
Sz
Ch
PwB
ROAD
WxB
AbB
Sz
water
Ch
Sz
19
20
Sz
WxB
Sz
AbB
Ch
w
AeB
AbB
WxB
PsB
PtB
Ur
PENN
CsB
w
Ch
Kg
Ch
PsB
Sz
Be
AeB
PtB
PwB
WxB
CoB
PtB
Be
Be
PtB
Be
PsB
Kg
AeB
POSEYVILLE

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

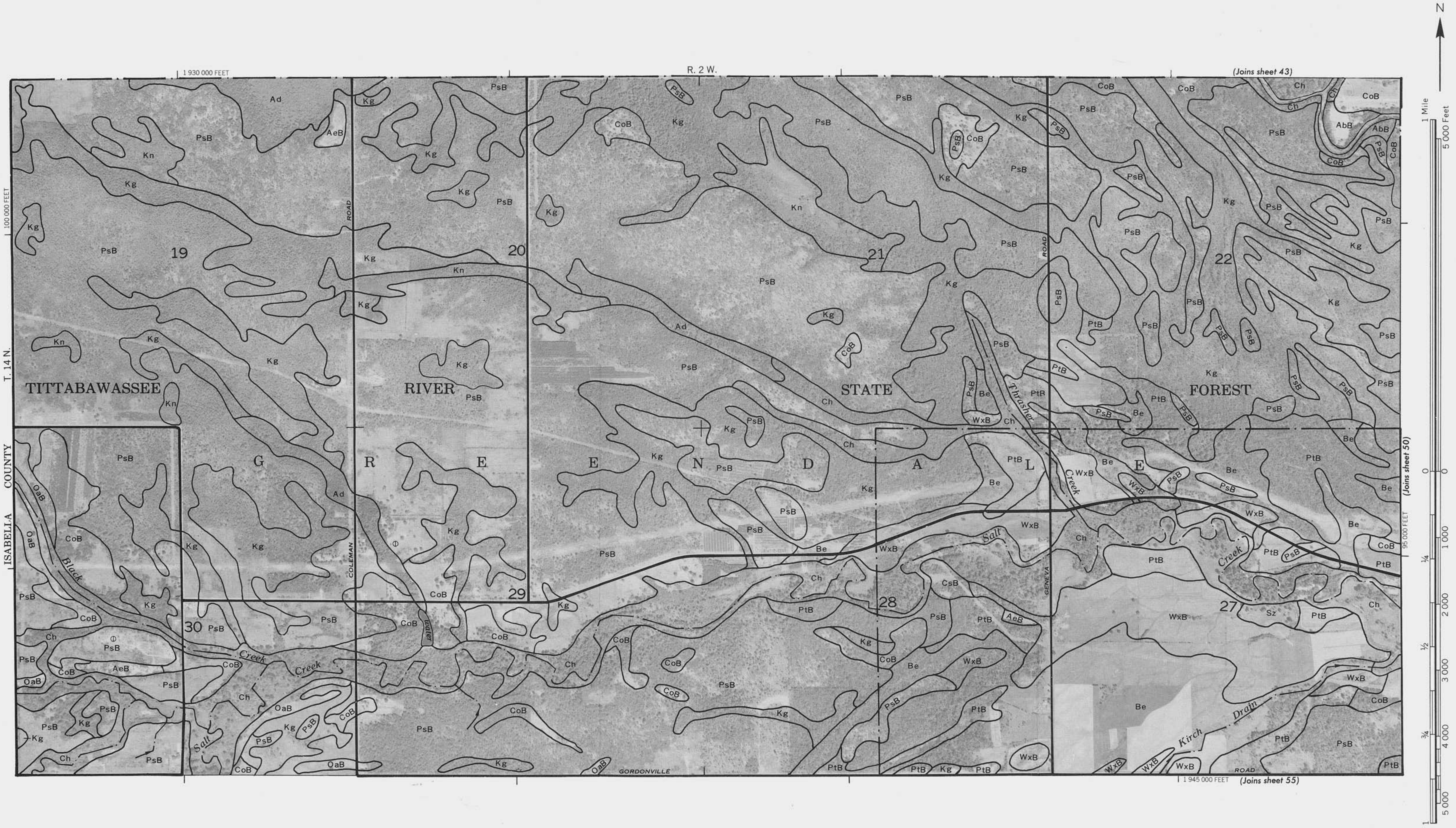
MIDLAND COUNTY, MICHIGAN NO. 48


N
1 Mile
5 000 Feet
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
1
(Joins sheet 42)
R. 2 E.
(Joins sheet 47)
(Joins sheet 54)
T. 14 N.
BAY COUNTY
105 000 FEET
2 035 000 FEET
MIDLAND
(county seat)
14
13
23
24
Engel Drain
Lingle Drain
ROAD
WALDO
PENN
CENTRAL
BAY CITY
ROAD
Golden
BR 10
10
water
w
PuB
WxB
PsB
Pa
LxA
PxB
Be
PtB
AeB
WzB
Ur
CsB


2 050 000 FEET
110 000 FEET
WxB
Pa
LxA
Pa
LxA
LxA
LxA
WxB
Pa
w
Pa
WxB
AeB
T. 14 N.
Pa
Golden
AeB
LxA
ROAD
BAY COUNTY
Pa
CsB
Pa
LxA
PxB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 49

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

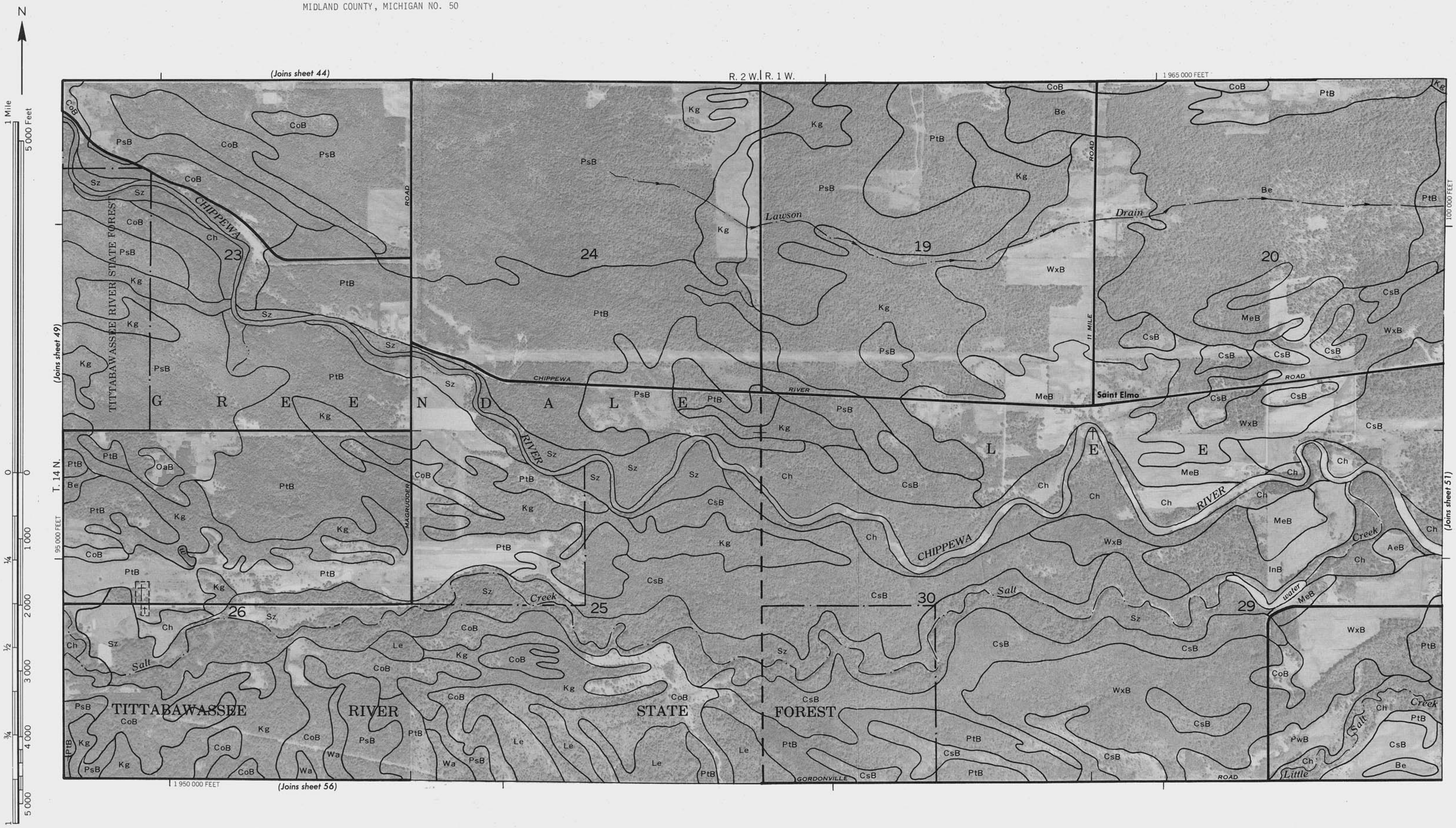

49
N
1 930 000 FEET
R. 2 W.
(Joins sheet 43)
100 000 FEET
T. 14 N.
ISABELLA COUNTY
(Joins sheet 50)
95 000 FEET
1 945 000 FEET
(Joins sheet 55)
TITTABAWASSEE RIVER STATE FOREST
G R E E N D A L E
19
20
21
22
27
28
29
30
COLEMAN ROAD
ROAD
GENEVA ROAD
GORDONVILLE ROAD
Black Creek
Salt Creek
Salt Creek
Thrasher Creek
Kirch Drain
Ad
AeB
AbB
Be
Ch
CoB
CsB
Kg
Kn
OaB
PsB
PtB
Sz
WxB
Water
1 Mile
5 000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000

㊿

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 50

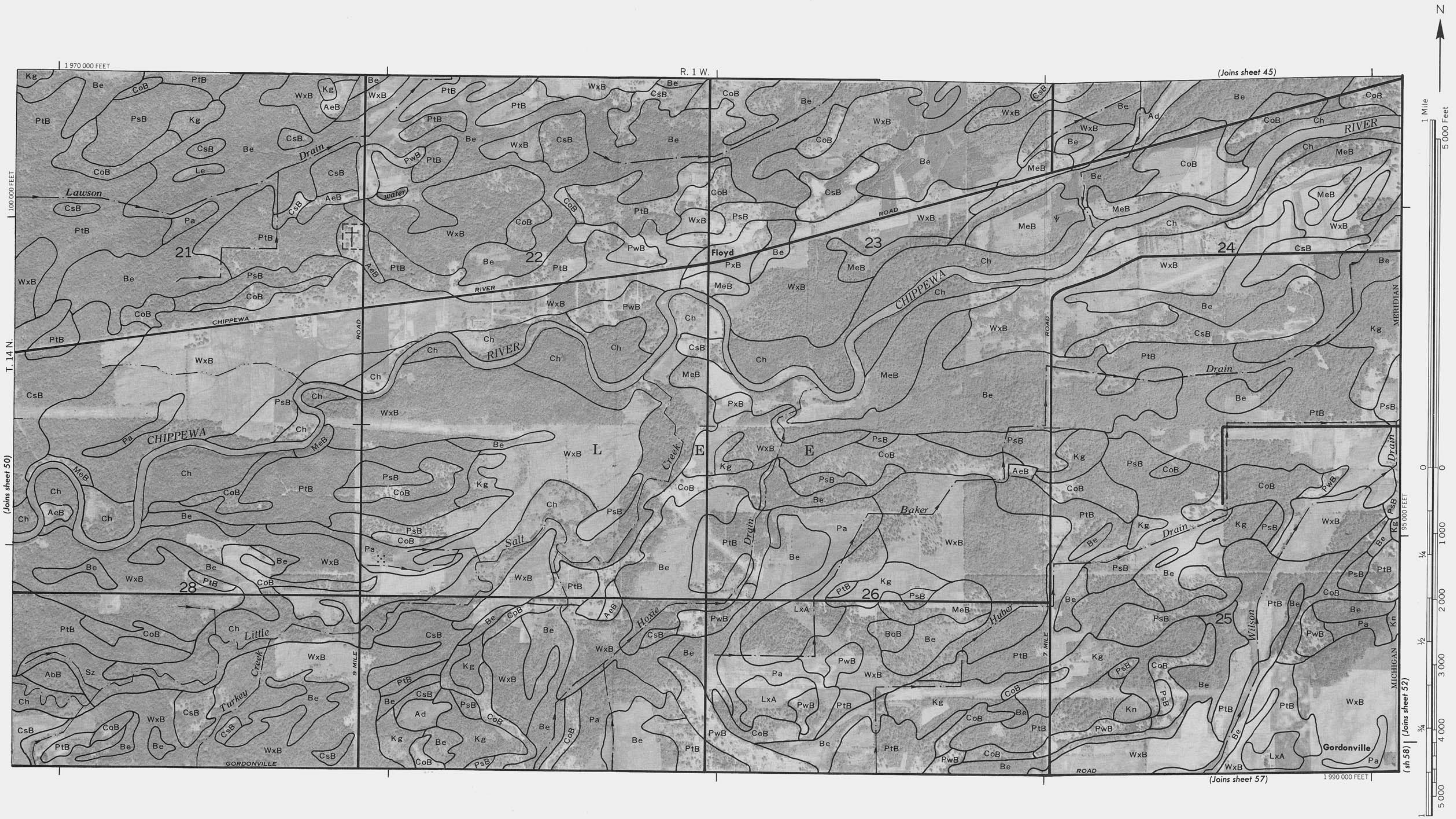
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 50


N
1 Mile
5 000 Feet
0
0
1 000
¼
2 000
½
3 000
4 000
¾
5 000
1
(Joins sheet 44)
R. 2 W.
R. 1 W.
1 965 000 FEET
100 000 FEET
(Joins sheet 49)
T. 14 N.
95 000 FEET
(Joins sheet 51)
1 950 000 FEET
(Joins sheet 56)
TITTABAWASSEE RIVER STATE FOREST
TITTABAWASSEE RIVER STATE FOREST
G R E E N D A L E
L E E
CHIPPEWA
CHIPPEWA RIVER
CHIPPEWA RIVER
RIVER
CHIPPEWA ROAD
ROAD
ROAD
MAGRUDDER
11 MILE ROAD
GORDONVILLE ROAD
Saint Elmo
Lawson Drain
Salt Creek
Salt Creek
Salt
Saltwater Creek
Little Salt Creek
23
24
19
20
26
25
30
29
CoB
PsB
Sz
Ch
Kg
PtB
OaB
Be
PsB
Kg
WxB
MeB
CsB
AeB
InB
Le
Wa
PwB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 51

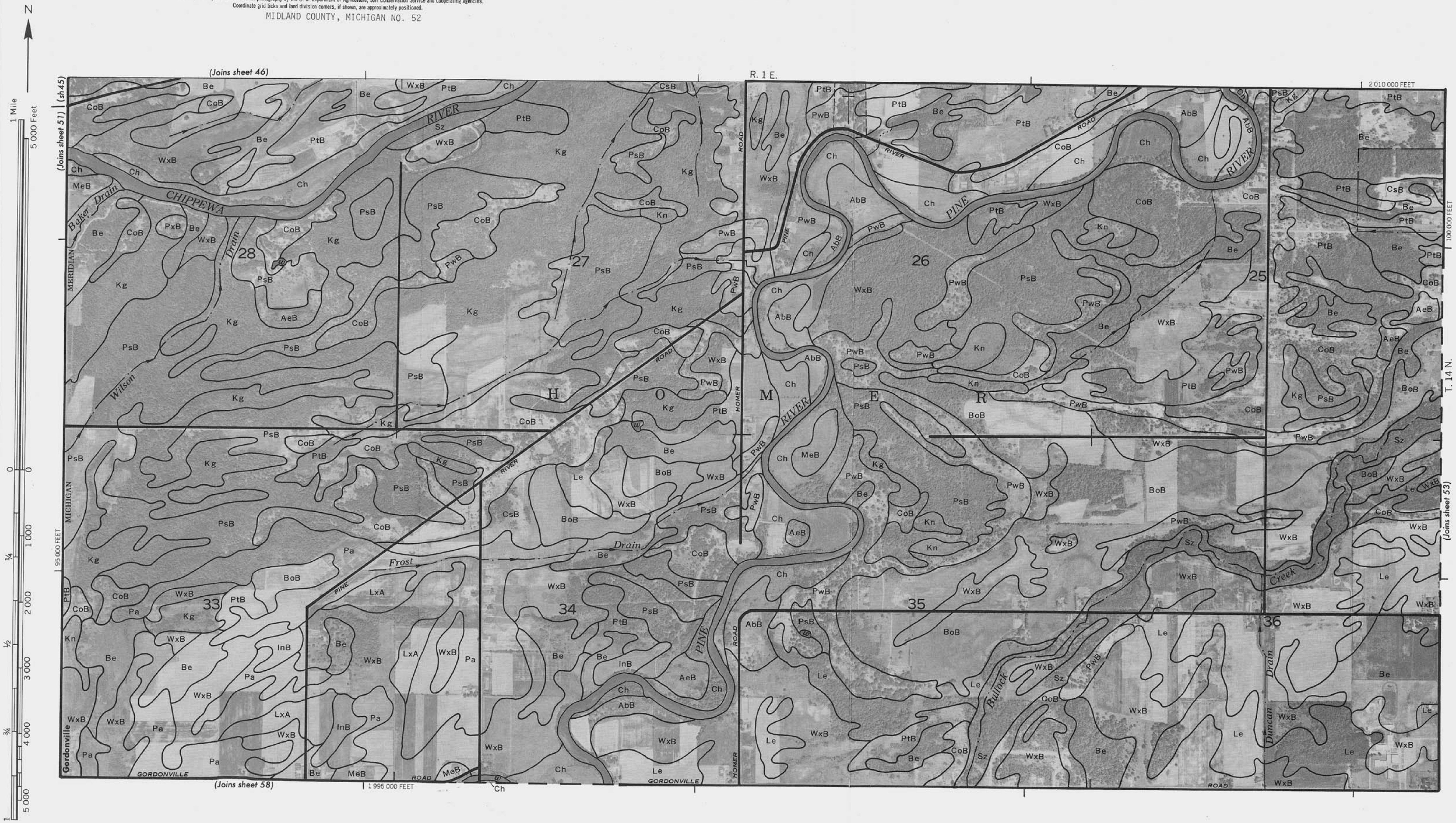
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 970 000 FEET
R. 1 W.
(Joins sheet 45)
100 000 FEET
T. 14 N.
(Joins sheet 50)
95 000 FEET
MERIDIAN
MICHIGAN
(Joins sheet 52)
(sh 58)
(Joins sheet 57)
1 990 000 FEET
21
22
23
24
25
26
28
Floyd
Gordonville
Lawson
Drain
CHIPPEWA
RIVER
ROAD
9 MILE
7 MILE
GORDONVILLE
Salt
Creek
Hoxie
Little
Turkey
Baker
Huber
Wilson
water
L
E
E
Kg
Be
PtB
CoB
WxB
AeB
PsB
CsB
Le
Pa
Ch
MeB
PwB
PxB
Ad
MeB
LxA
BoB
AbB
Sz
Kn
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 52

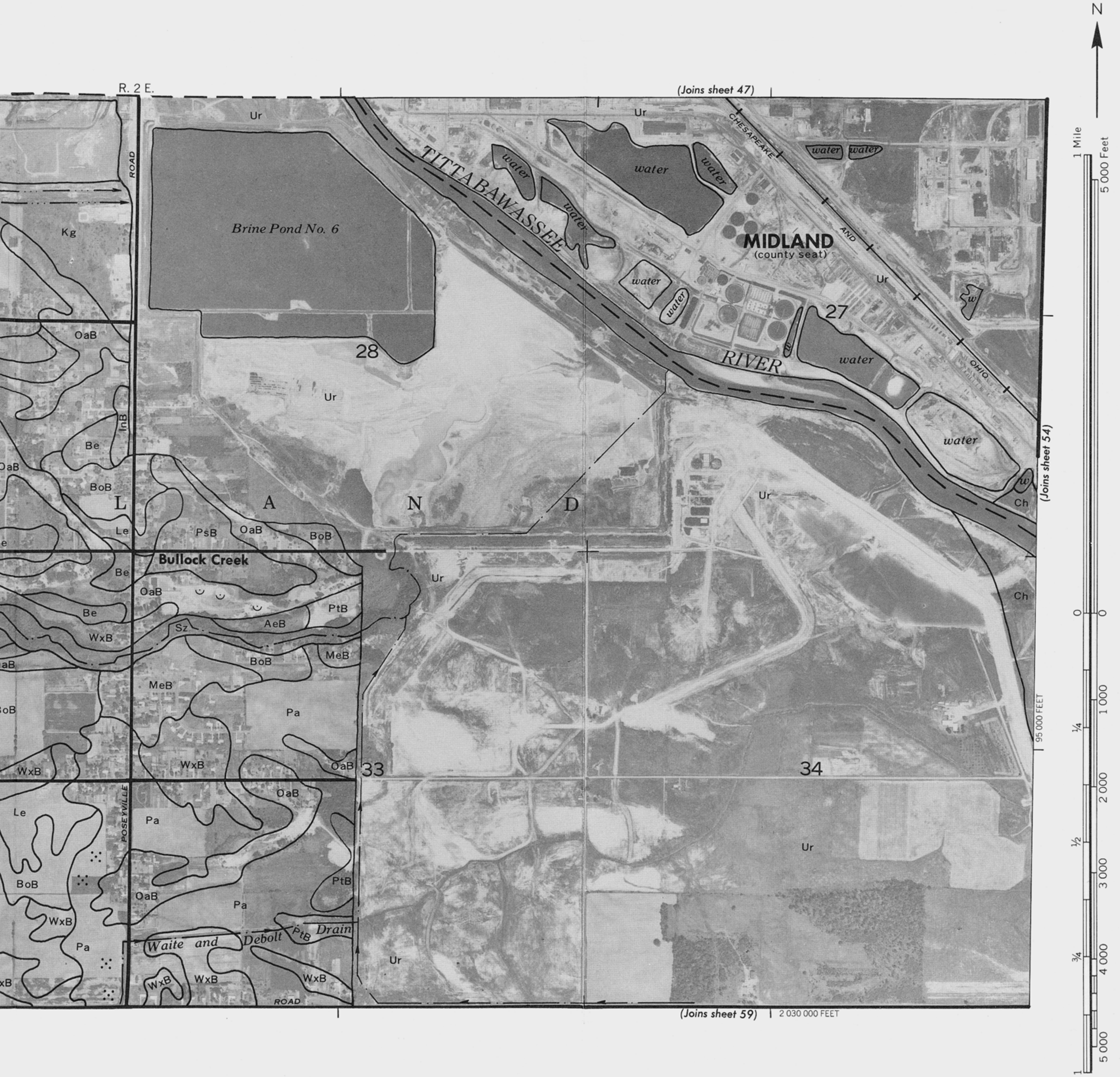
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

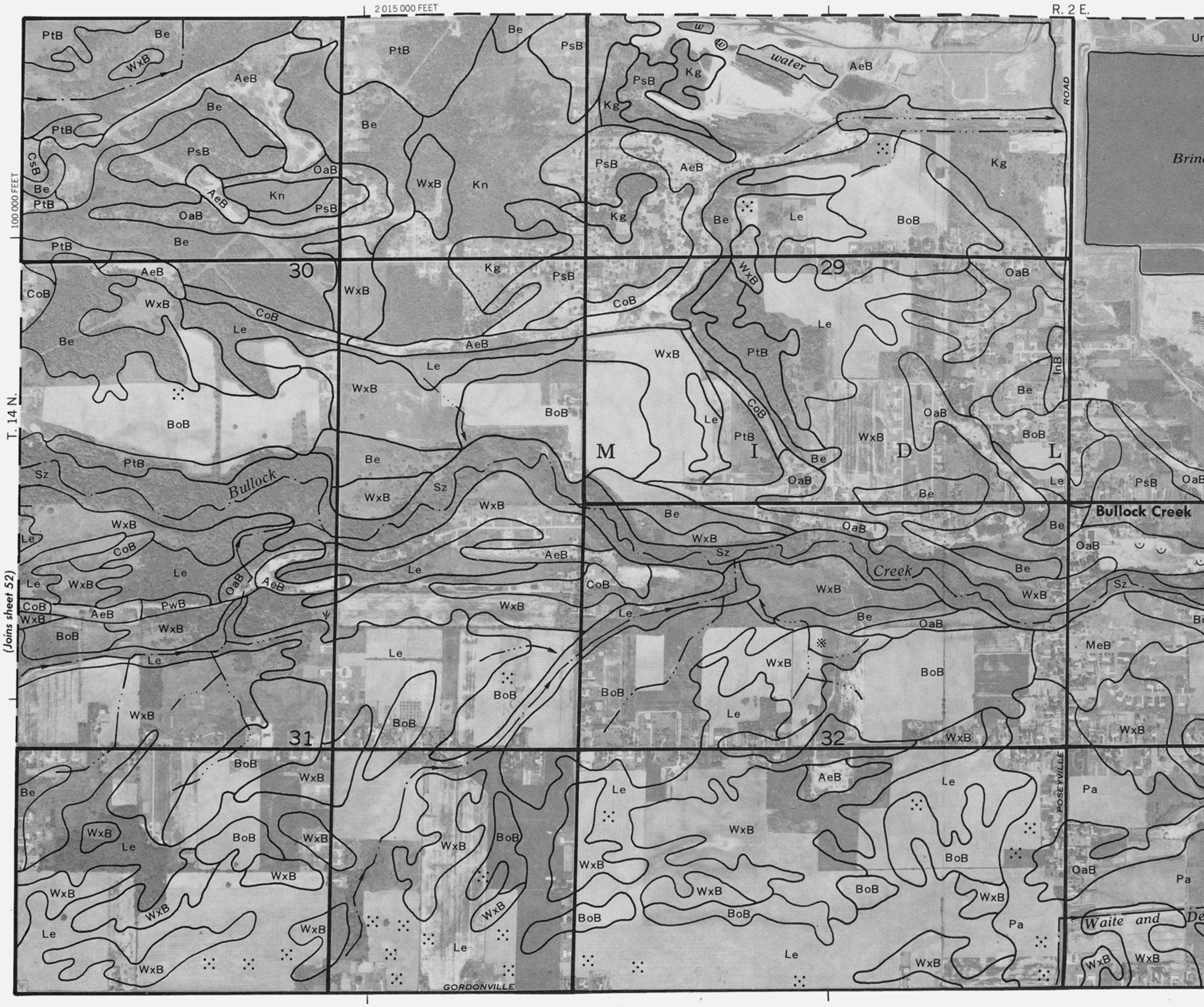
MIDLAND COUNTY, MICHIGAN NO. 52


N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
(Joins sheet 46)
(Joins sheet 51)
(sh45)
(Joins sheet 53)
(Joins sheet 58)
R. 1 E.
T. 14 N.
2 010 000 FEET
100 000 FEET
95 000 FEET
1 995 000 FEET
MERIDIAN
MICHIGAN
Gordonville
GORDONVILLE
ROAD
HOMER
ROAD
CHIPPEWA
RIVER
PINE
RIVER
Baker
Drain
Wilson
Drain
Frost
Drain
Bullock
Duncan
Drain
Creek
H
O
M
E
R
25
26
27
28
33
34
35
36

COUNTY, MICHIGAN — SHEET NUMBER 53

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
R. 2 E.
(Joins sheet 47)
(Joins sheet 54)
(Joins sheet 59)
2 030 000 FEET
95 000 FEET
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1 000
2 000
3 000
4 000
5 000
Ur
water
Brine Pond No. 6
TITTABAWASSEE
RIVER
CHESAPEAKE
AND
OHIO
MIDLAND
(county seat)
w
27
28
33
34
L
A
N
D
Kg
OaB
InB
Be
BoB
Le
PsB
Bullock Creek
AeB
PtB
Sz
WxB
MeB
Pa
Ch
ROAD
POSEYVILLE
Waite and Debolt Drain
ROAD

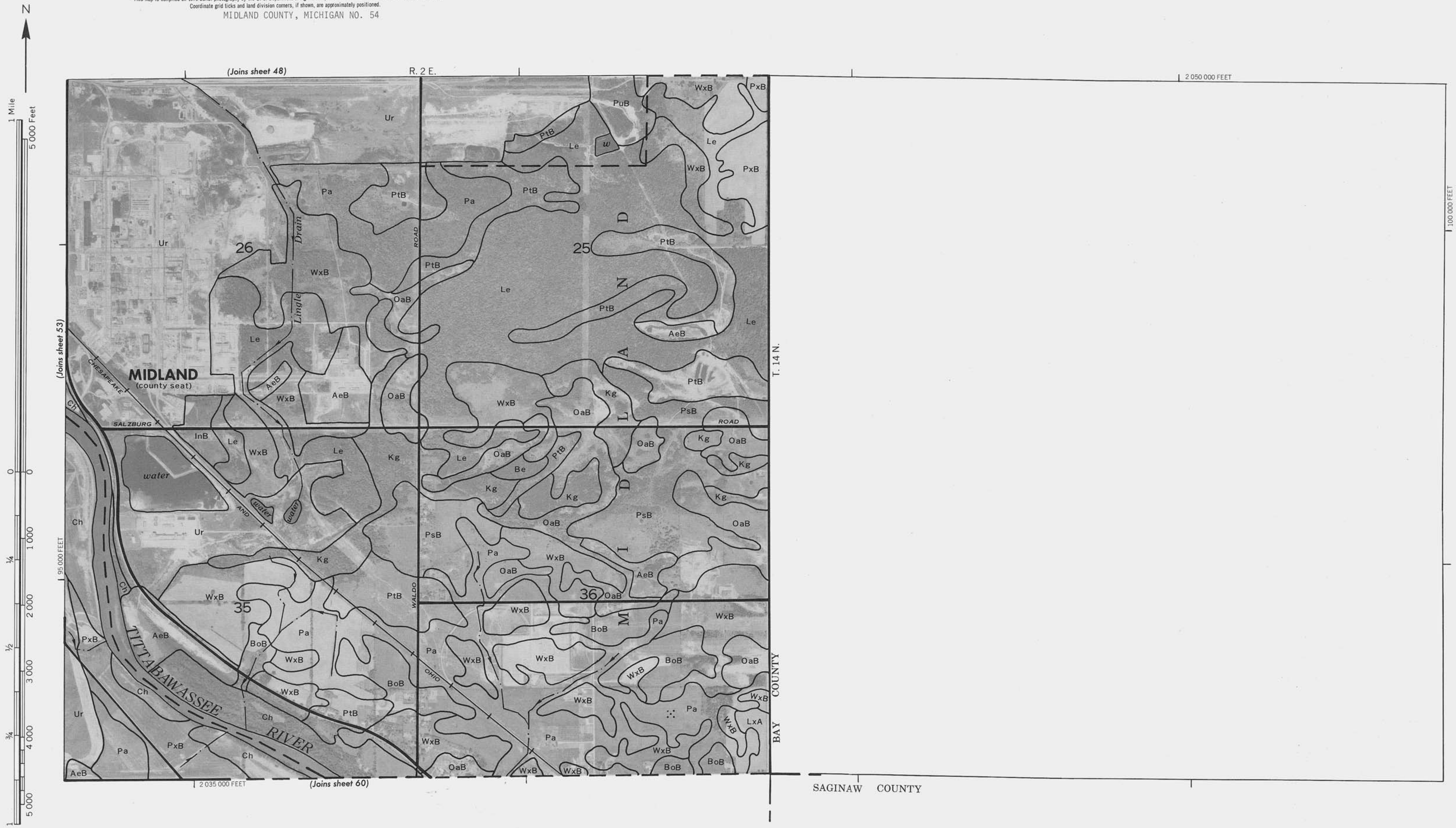

2 015 000 FEET
R. 2 E.
100 000 FEET
T. 14 N.
(Joins sheet 52)
30
29
31
32
M
I
D
L
ROAD
POSEYVILLE
GORDONVILLE
water
w
Brin
Ur
Bullock
Creek
Bullock Creek
Waite and
De
PtB
Be
WxB
AeB
PsB
CsB
OaB
Kn
Kg
CoB
Le
BoB
Sz
PwB
InB
MeB
Pa

(54)

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 54

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

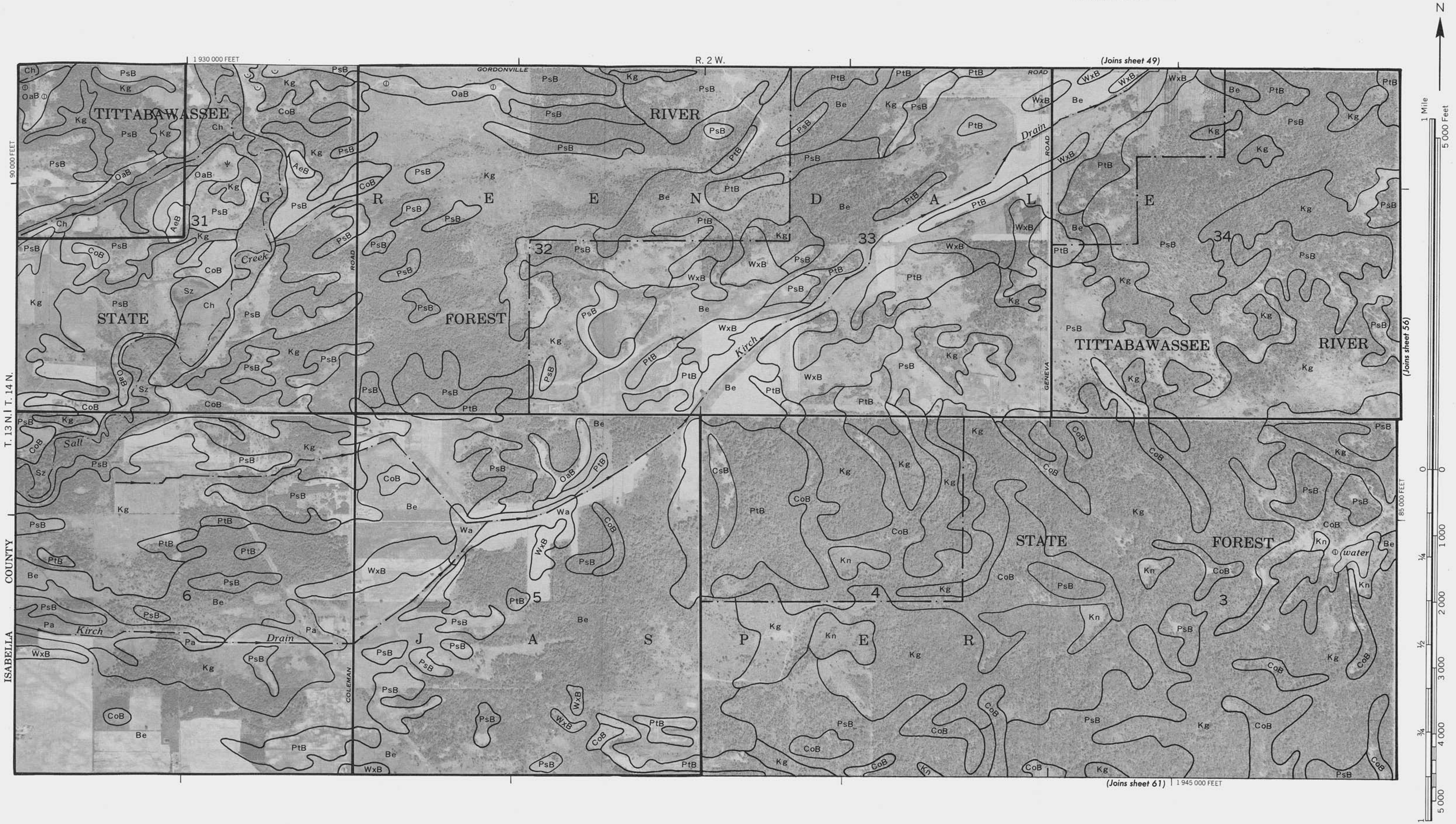
MIDLAND COUNTY, MICHIGAN NO. 54


N
1 Mile
5 000 Feet
0
0
¼
1 000
2 000
½
3 000
¾
4 000
5 000
1
(Joins sheet 48)
R. 2 E.
2 050 000 FEET
100 000 FEET
(Joins sheet 53)
95 000 FEET
T. 14 N.
2 035 000 FEET
(Joins sheet 60)
BAY COUNTY
SAGINAW COUNTY
MIDLAND
(county seat)
MIDLAND
Lingle Drain
ROAD
SALZBURG
ROAD
CHESAPEAKE AND OHIO
WALDO
TITTABAWASSEE RIVER
water
water
water
w
26
25
35
36
Ur
Pa
PtB
WxB
PxB
PuB
Le
OaB
AeB
InB
Kg
Be
PsB
Ch
BoB
LxA

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 55

MIDLAND COUNTY, MICHIGAN NO. 55

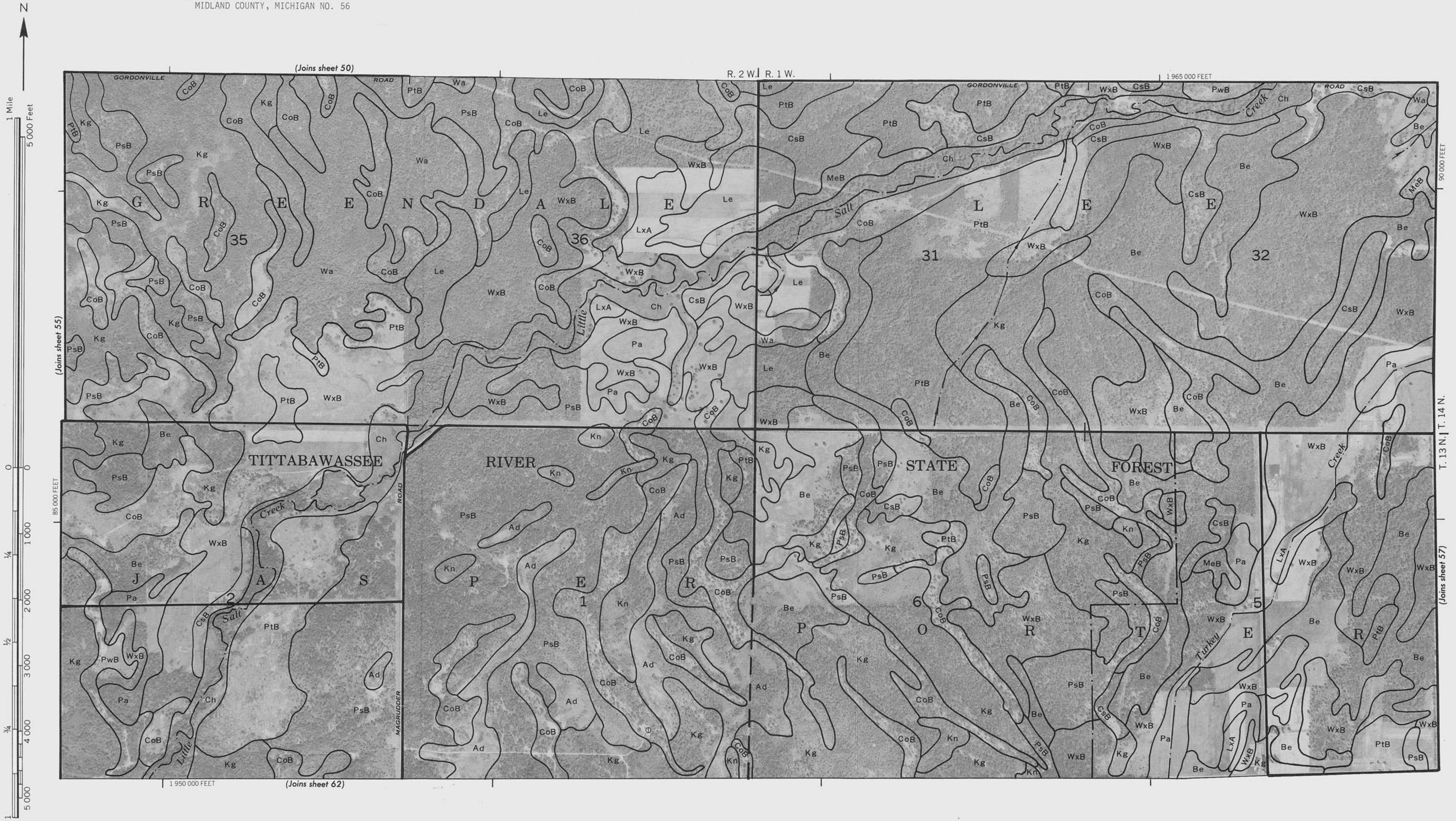
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 49)
1 930 000 FEET
R. 2 W.
90 000 FEET
T. 13 N. | T. 14 N.
ISABELLA COUNTY
(Joins sheet 56)
(Joins sheet 61)
1 945 000 FEET
85 000 FEET
TITTABAWASSEE RIVER
GREENDALE
STATE FOREST
TITTABAWASSEE RIVER
JASPER
STATE FOREST
GORDONVILLE ROAD
GENEVA ROAD
COLEMAN
Creek
Salt
Kirch Drain
Drain
water
31
32
33
34
6
5
4
3
Ch
OaB
PsB
Kg
CoB
AeB
Be
PtB
WxB
Sz
Wa
Pa
CsB
Kn
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
1000
2000
3000
4000
5 000

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 56

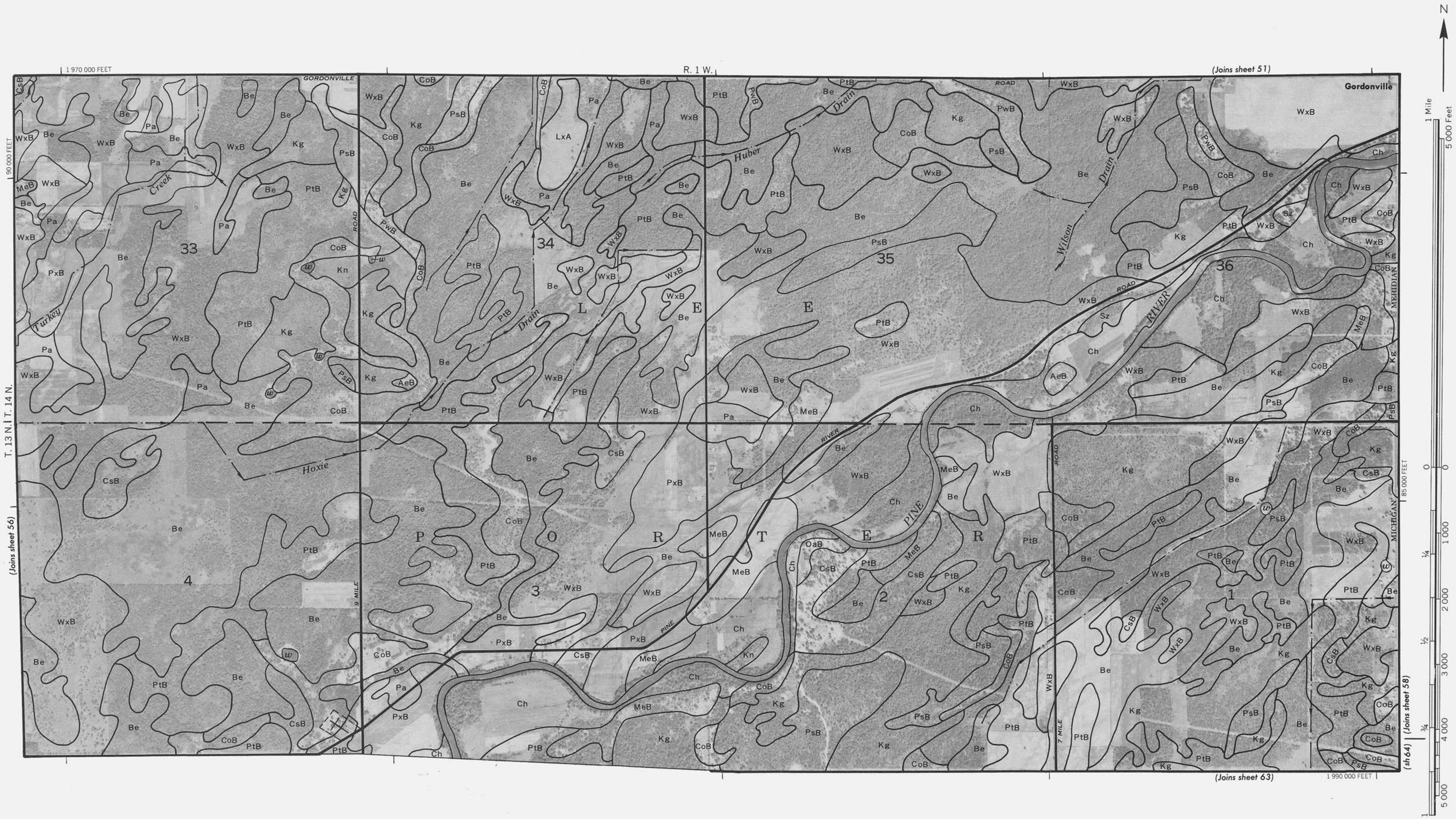
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 56


N
1 Mile
5 000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5 000
(Joins sheet 50)
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 62)
R. 2 W.
R. 1 W.
T. 14 N.
T. 13 N.
1 965 000 FEET
1 950 000 FEET
90 000 FEET
85 000 FEET
GORDONVILLE ROAD
MAGRUDDER ROAD
GREENDALE
LEE
JASPER
PORTER
TITTABAWASSEE RIVER STATE FOREST
35
36
31
32
2
1
6
5
Salt Creek
Little Salt Creek
Turkey Creek
Creek
Little Salt
CoB
CsB
Kg
PsB
PtB
Wa
Le
WxB
LxA
Ch
Pa
Be
MeB
PwB
Kn
Ad

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 57

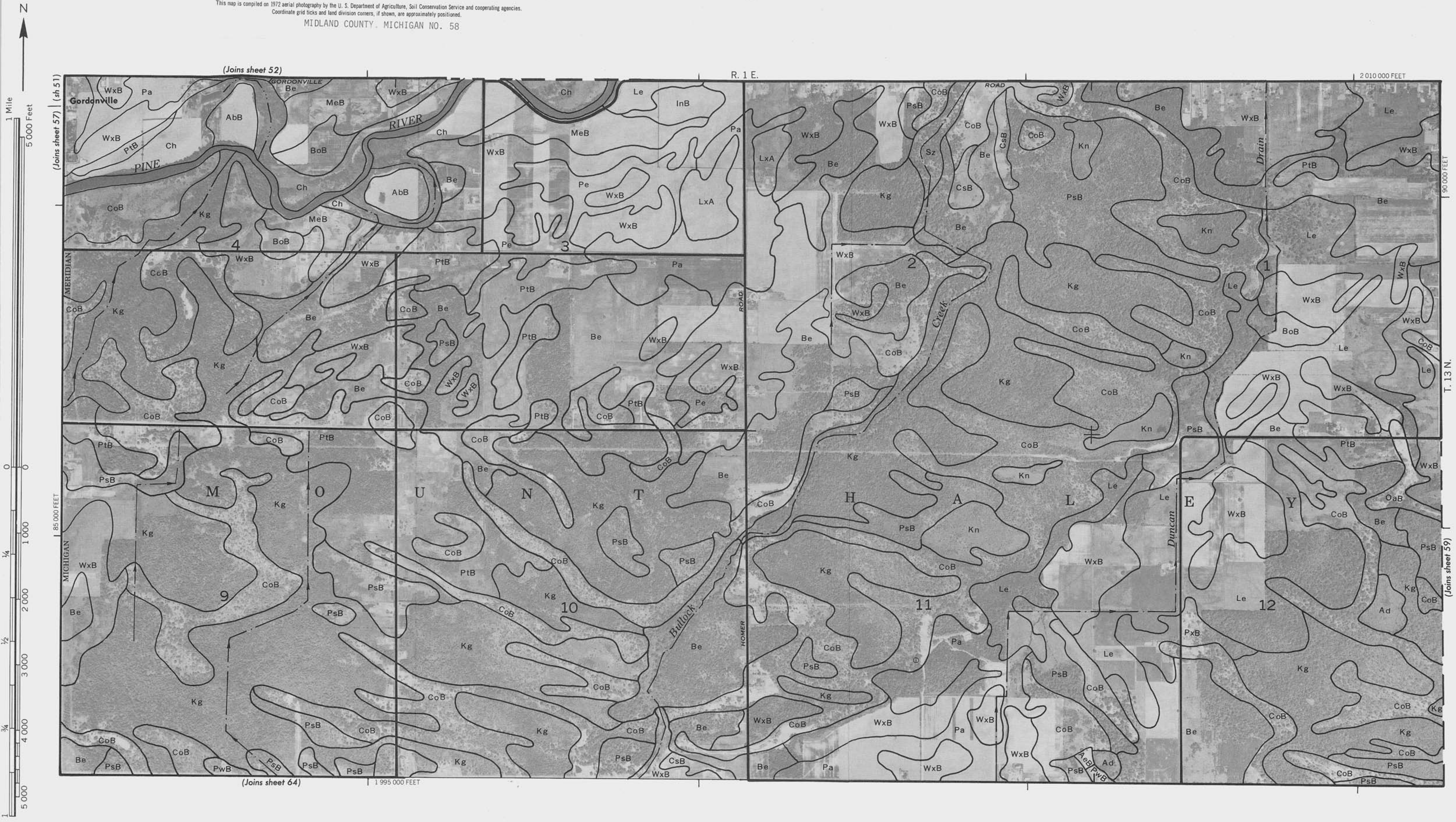
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 970 000 FEET
R. 1 W.
(Joins sheet 51)
Gordonville
GORDONVILLE ROAD
90 000 FEET
T. 13 N. | T. 14 N.
(Joins sheet 56)
(Joins sheet 58)
(sh 64)
(Joins sheet 63)
1 990 000 FEET
85 000 FEET
MERIDIAN
MICHIGAN
9 MILE ROAD
7 MILE ROAD
ROAD
Turkey Creek
Hoxie Drain
Huber Drain
Wilson Drain
PINE RIVER
33
34
35
36
4
3
2
1
L E E
P O R T E R
w
Be
Ch
CoB
CsB
Kg
Kn
LxA
MeB
OaB
Pa
PsB
PtB
PwB
PxB
Sz
WxB
AeB
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5 000
¼
½
¾
1

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 58

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

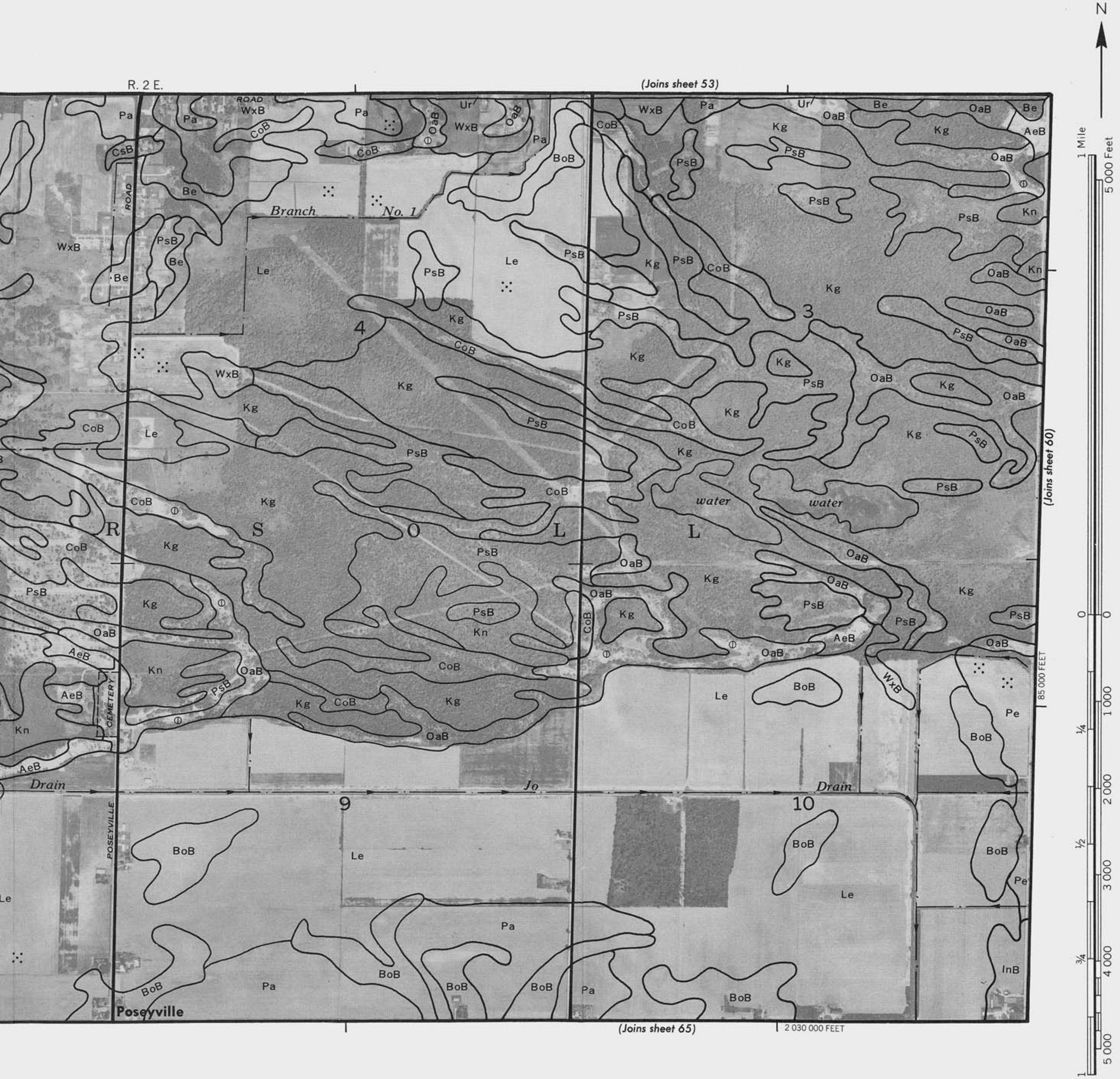
MIDLAND COUNTY, MICHIGAN NO. 58

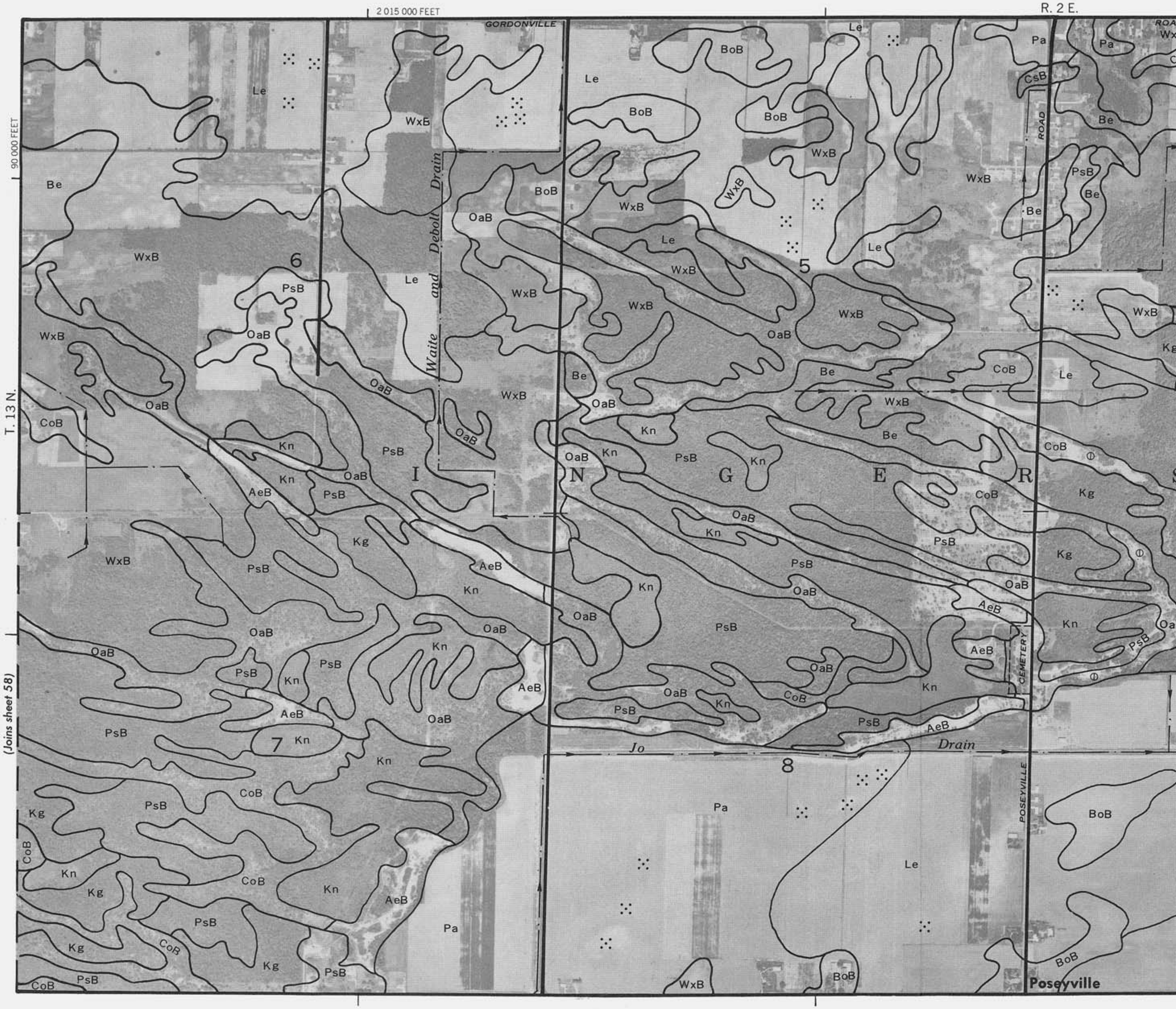

N
1 Mile
5 000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5 000
(Joins sheet 52)
(Joins sheet 57)
(sh 51)
(Joins sheet 64)
(Joins sheet 59)
R. 1 E.
T. 13 N.
2 010 000 FEET
1 995 000 FEET
90 000 FEET
85 000 FEET
Gordonville
GORDONVILLE
ROAD
PINE
RIVER
MERIDIAN
MICHIGAN
HOMER
Creek
Bullock
Drain
Duncan
M O U N T   H A L E Y
1
2
3
4
9
10
11
12
WxB
Pa
Be
MeB
AbB
PtB
Ch
BoB
CoB
Kg
Le
InB
MeB
Pe
LxA
PsB
Sz
CsB
Kn
OaB
Ad
PxB
AeB
PwB
CsB

COUNTY, MICHIGAN — SHEET NUMBER 59

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

59

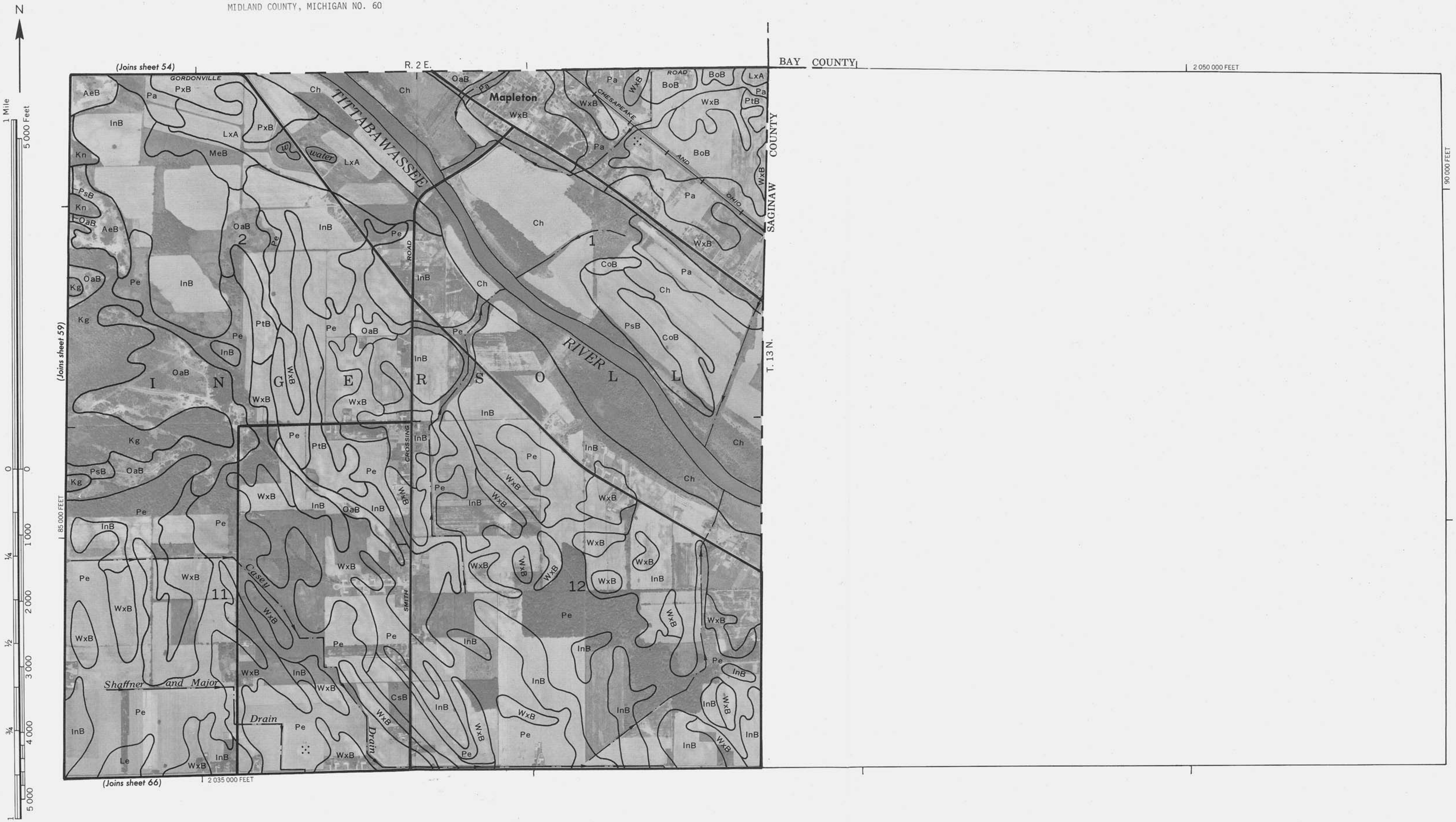

N
R. 2 E.
(Joins sheet 53)
(Joins sheet 60)
(Joins sheet 65)
85 000 FEET
2 030 000 FEET
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1 000
2 000
3 000
4 000
5 000
ROAD
ROAD
Branch
No. 1
Drain
Jo
Drain
POSEYVILLE
CEMETERY
Poseyville
water
water
R
S
O
L
L
3
4
9
10
Pa
WxB
CoB
CsB
Ur
OaB
Be
AeB
Kg
PsB
Kn
BoB
Le
Kn
Pe
InB


2 015 000 FEET
R. 2 E.
90 000 FEET
T. 13 N.
(Joins sheet 58)
GORDONVILLE
ROAD
CEMETERY
POSEYVILLE
Poseyville
Waite and Debolt Drain
Jo Drain
6
5
7
8
I N G E R S
Le
Be
WxB
BoB
PsB
OaB
CoB
Kn
AeB
Kg
Pa
CsB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 60

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

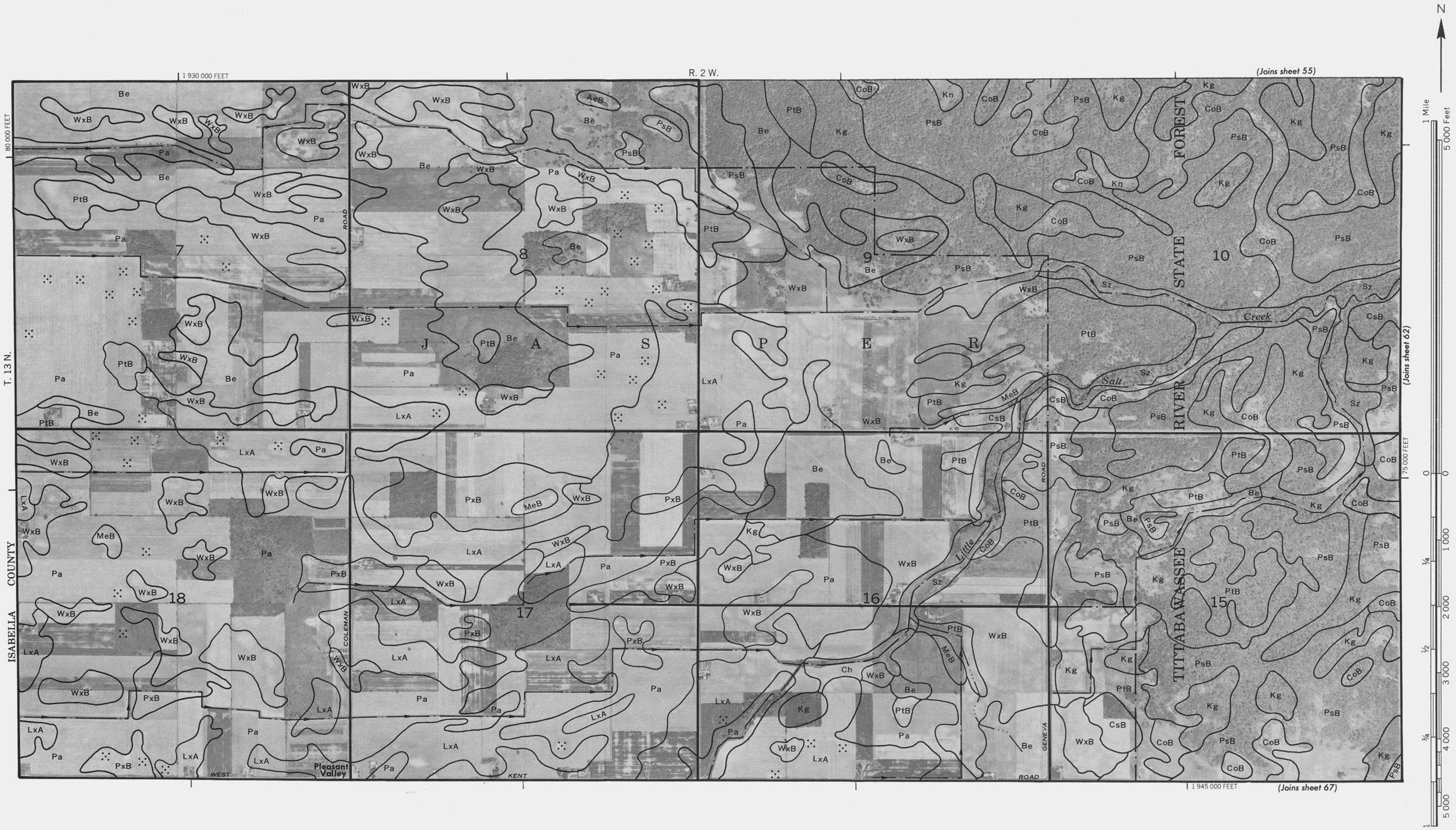
MIDLAND COUNTY, MICHIGAN NO. 60


N
1 Mile
5 000 Feet
0
0
1 000
¼
2 000
½
3 000
¾
4 000
1
5 000
(Joins sheet 54)
R. 2 E.
BAY COUNTY
2 050 000 FEET
90 000 FEET
(Joins sheet 59)
85 000 FEET
(Joins sheet 66)
2 035 000 FEET
SAGINAW COUNTY
T. 13 N.
GORDONVILLE
TITTABAWASSEE
RIVER
Mapleton
CHESAPEAKE AND OHIO
ROAD
SMITH CROSSING ROAD
INGERSOLL
Casey
Shaffner and Major Drain
Drain
water
1
2
11
12
AeB
Pa
PxB
InB
LxA
MeB
Kn
PsB
OaB
Kg
Pe
PtB
Ch
OaB
WxB
BoB
LxA
PtB
CoB
Le
CsB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 61

MIDLAND COUNTY, MICHIGAN NO. 61

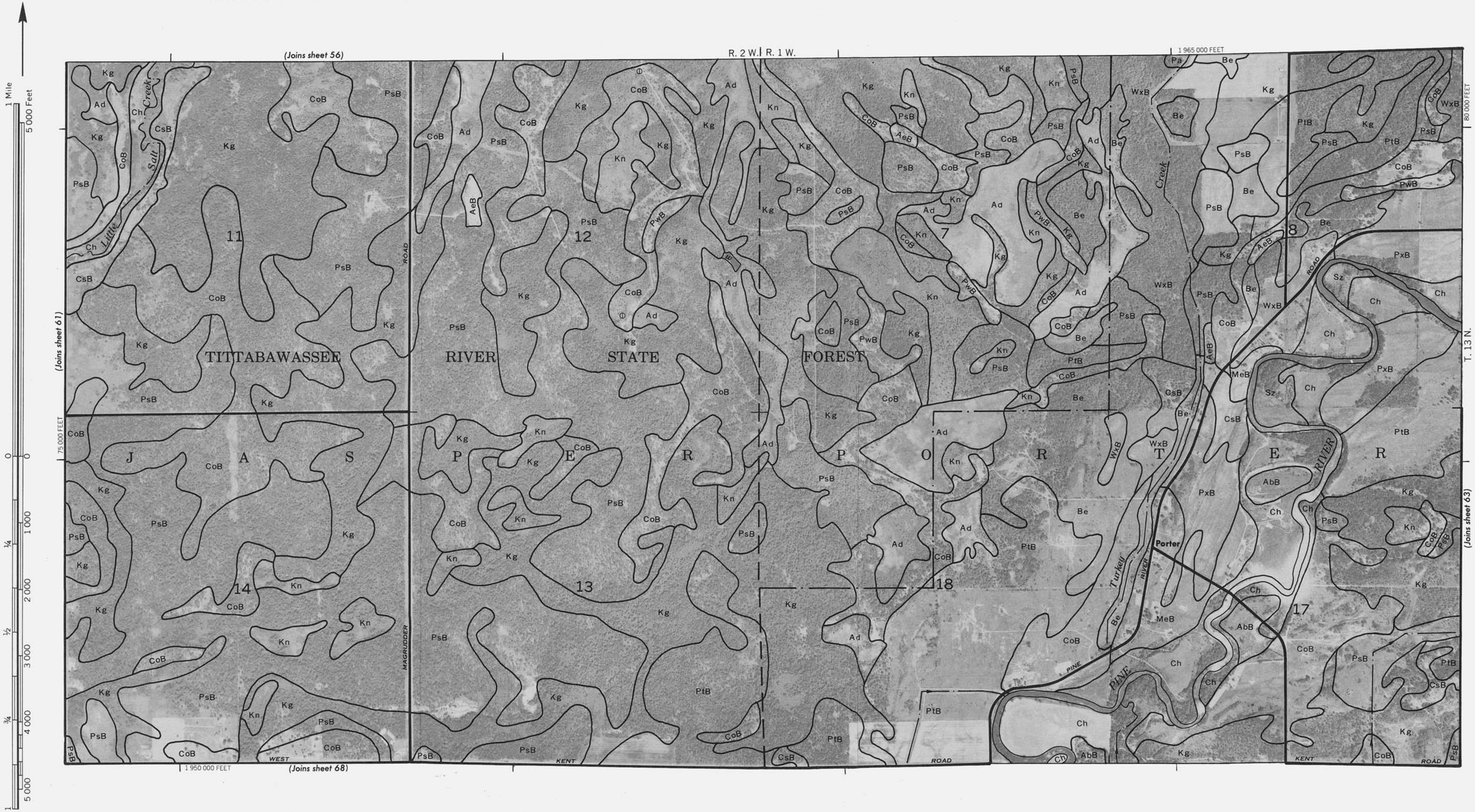
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 930 000 FEET
R. 2 W.
(Joins sheet 55)
80 000 FEET
T. 13 N.
ISABELLA COUNTY
(Joins sheet 62)
75 000 FEET
1 945 000 FEET
(Joins sheet 67)
JASPER
STATE FOREST
TITTABAWASSEE RIVER
Salt Creek
Little
ROAD
COLEMAN
WEST
KENT
GENEVA
ROAD
Pleasant Valley
7
8
9
10
18
17
16
15
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
0
1000
2000
3000
4000
5000
Be
WxB
Pa
PtB
LxA
PxB
MeB
AeB
PsB
Kg
Kn
CoB
CsB
Sz
Ch

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 62

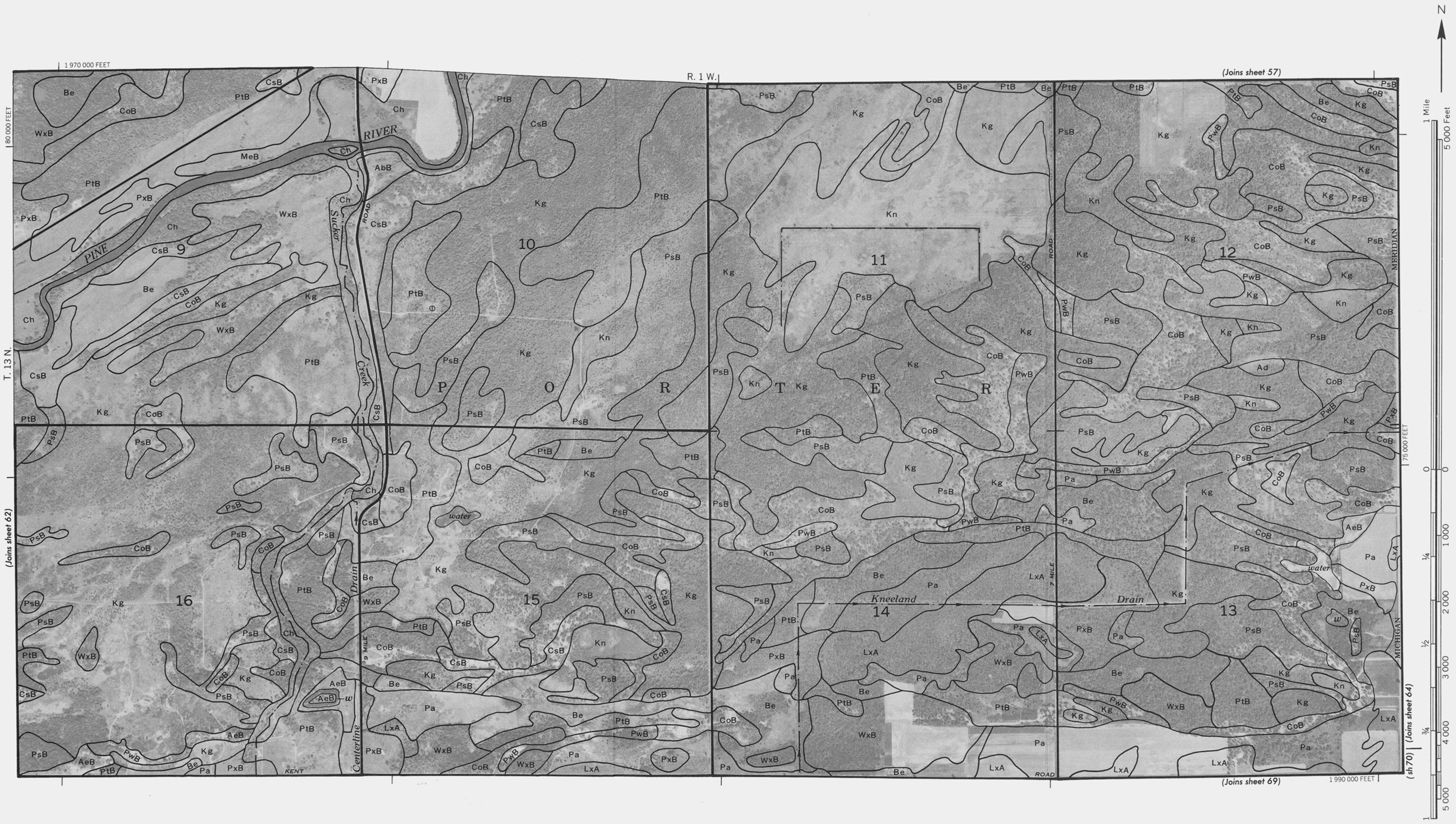
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 62


N
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
(Joins sheet 56)
R. 2 W.
R. 1 W.
1 965 000 FEET
80 000 FEET
T. 13 N.
(Joins sheet 63)
(Joins sheet 61)
75 000 FEET
1 950 000 FEET
(Joins sheet 68)
TITTABAWASSEE RIVER STATE FOREST
J A S P E R
P O R T E R
7
8
11
12
13
14
17
18
Porter
Little Salt Creek
Creek
Turkey Creek
ROAD
MAGRUDDER
WEST
KENT
ROAD
PINE
PINE RIVER
RIVER
Kg
Ad
Ch
CsB
CoB
PsB
Kn
AeB
PwB
Be
WxB
Pa
PtB
PxB
Sz
MeB
AbB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 63

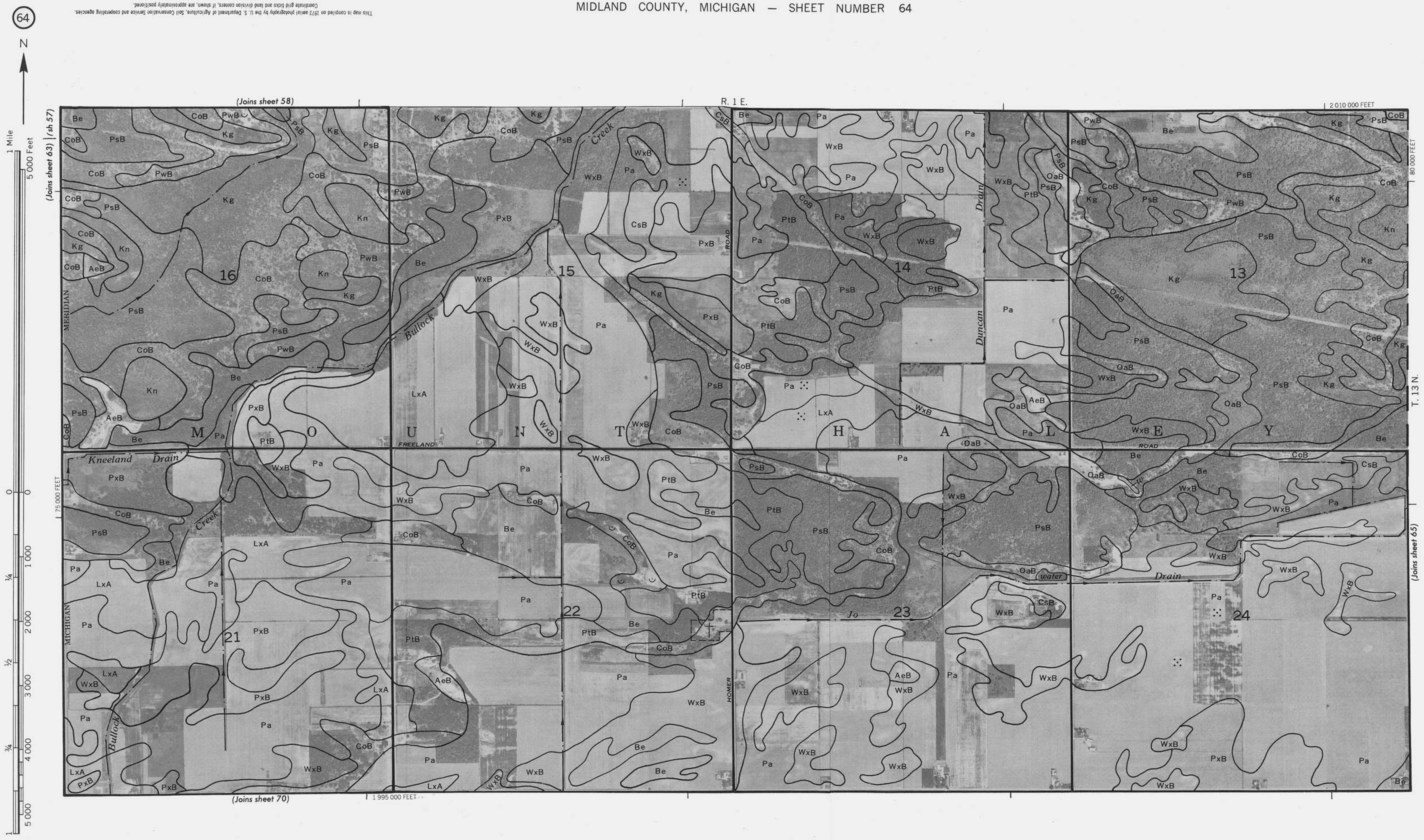
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 970 000 FEET
R. 1 W.
(Joins sheet 57)
80 000 FEET
T. 13 N.
(Joins sheet 62)
75 000 FEET
MERIDIAN
MICHIGAN
(Joins sheet 64)
(sh 70)
(Joins sheet 69)
1 990 000 FEET
1 Mile
5 000 Feet
0
1/4
1/2
3/4
0
1000
2000
3000
4000
5000
PINE
RIVER
Sucker
Creek
Drain
ROAD
9 MILE
Centerline
KENT
Kneeland
Drain
7 MILE
ROAD
P O R T E R
9
10
11
12
13
14
15
16
water
water
w
Be
CoB
WxB
PtB
CsB
PxB
MeB
Ch
AbB
Kg
Kn
PsB
PwB
Ad
AeB
Pa
LxA

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

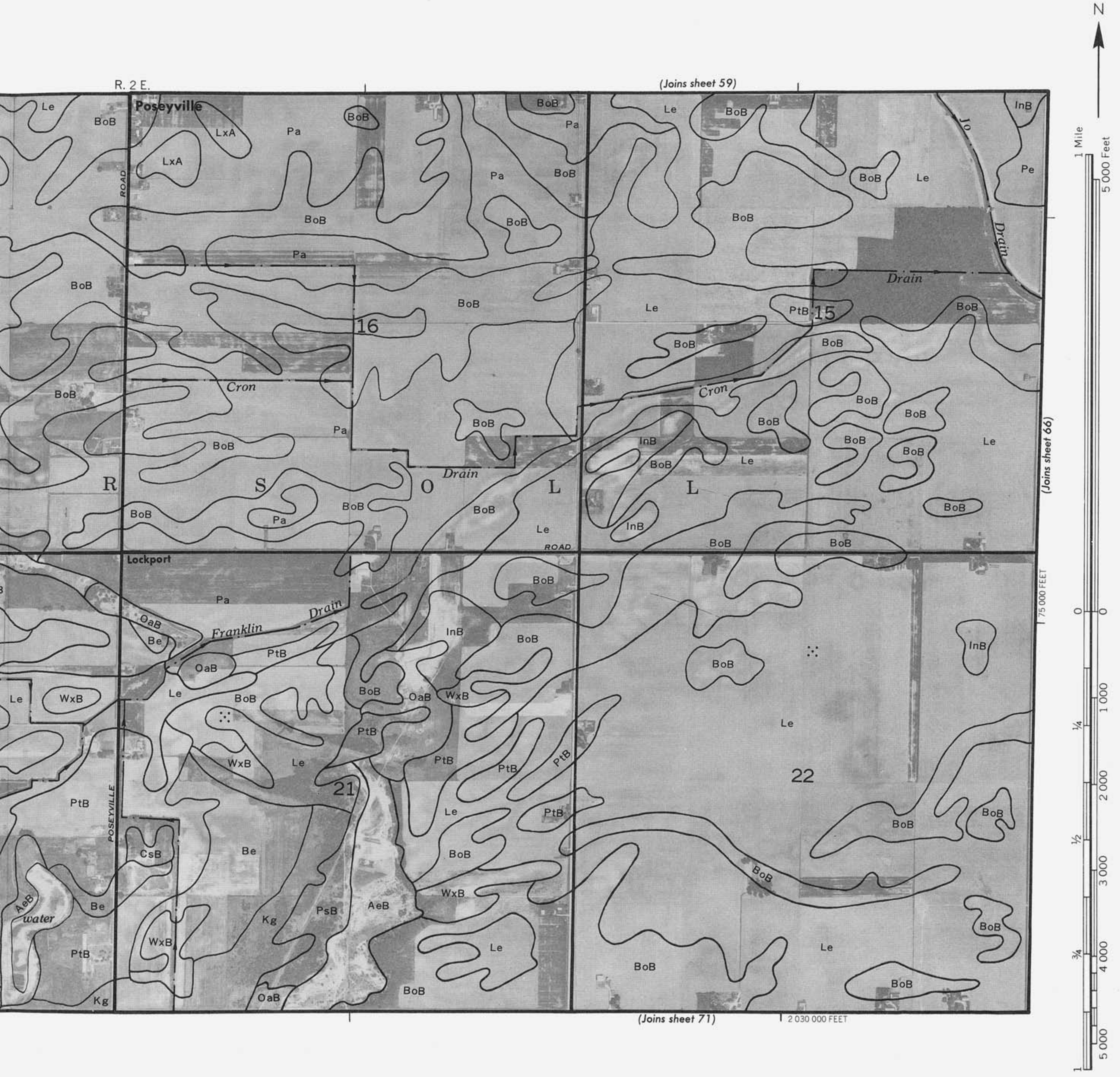
MIDLAND COUNTY, MICHIGAN NO. 64

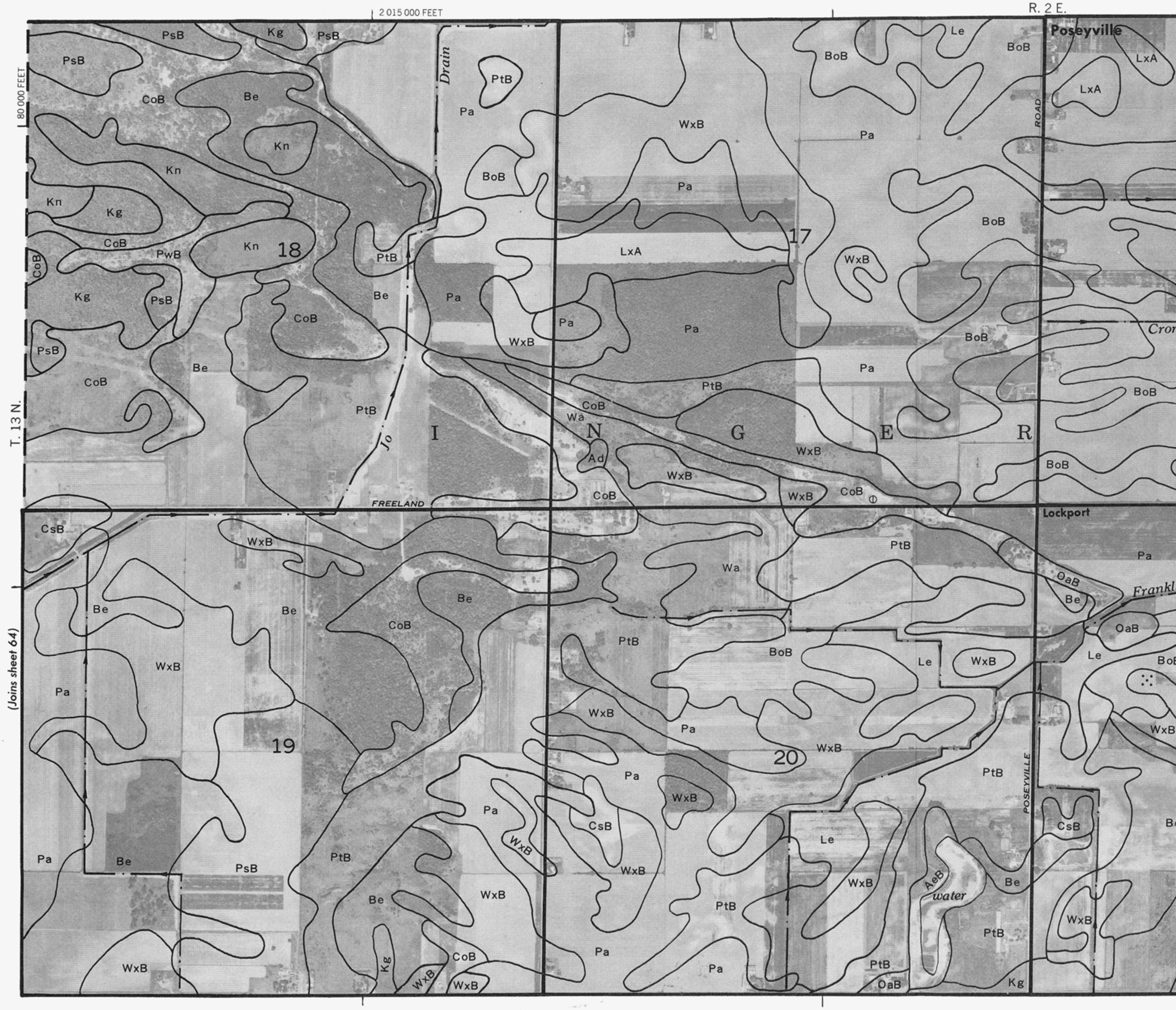
MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 64



64
N
1 Mile
5 000 Feet
0
1 000
¼
2 000
½
3 000
¾
4 000
5 000
(Joins sheet 58)
(Joins sheet 63)
(sh 57)
(Joins sheet 65)
(Joins sheet 70)
R. 1 E.
T. 13 N.
2 010 000 FEET
80 000 FEET
75 000 FEET
1 995 000 FEET
MOUNT HALEY
13
14
15
16
21
22
23
24
MERIDIAN
MICHIGAN
FREELAND
ROAD
HOMER
Duncan
Drain
Bullock Creek
Kneeland Drain
Creek
Jo
water
Be
CoB
PsB
PwB
Kg
Kn
AeB
PxB
PtB
Pa
WxB
LxA
CsB
OaB

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

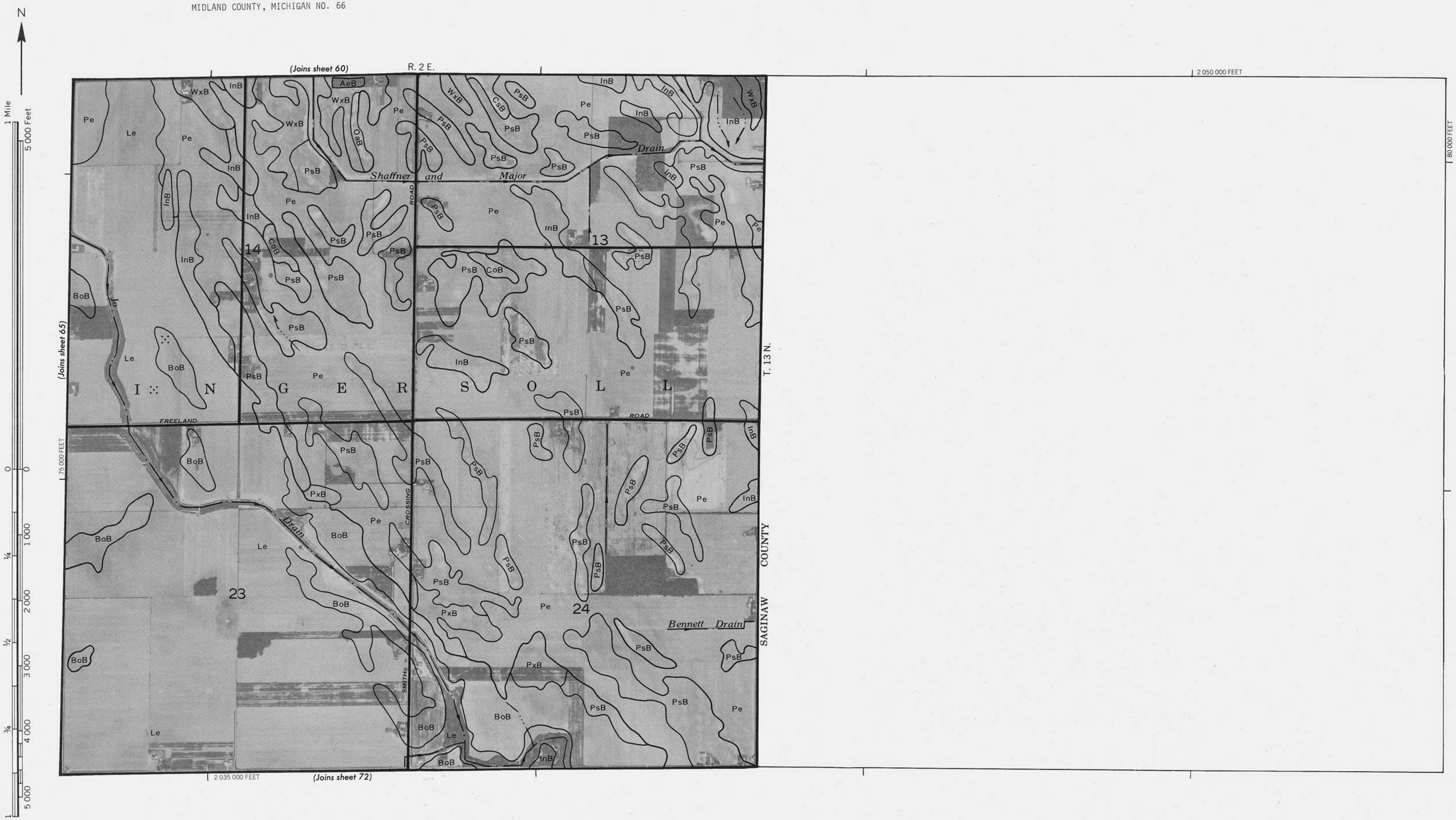

N
R. 2 E.
(Joins sheet 59)
(Joins sheet 66)
(Joins sheet 71)
75 000 FEET
2 030 000 FEET
Poseyville
Lockport
POSEYVILLE
ROAD
ROAD
Cron
Cron
Drain
Drain
Franklin
Drain
Jo
Drain
water
R S O L L
15
16
21
22
Le
BoB
LxA
Pa
Pe
InB
PtB
OaB
Be
WxB
CsB
AeB
PsB
Kg
1 Mile
5 000 Feet
0
¼
½
¾
1
0
1 000
2 000
3 000
4 000
5 000


2 015 000 FEET
R. 2 E.
80 000 FEET
T. 13 N.
(Joins sheet 64)
Poseyville
Lockport
FREELAND
ROAD
POSEYVILLE
Drain
Jo
Cron
Frankl
I
N
G
E
R
17
18
19
20
water
PsB
Kg
CoB
Be
Kn
PwB
PtB
Pa
BoB
WxB
LxA
Le
Wa
Ad
CsB
OaB
AeB

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN NO. 66

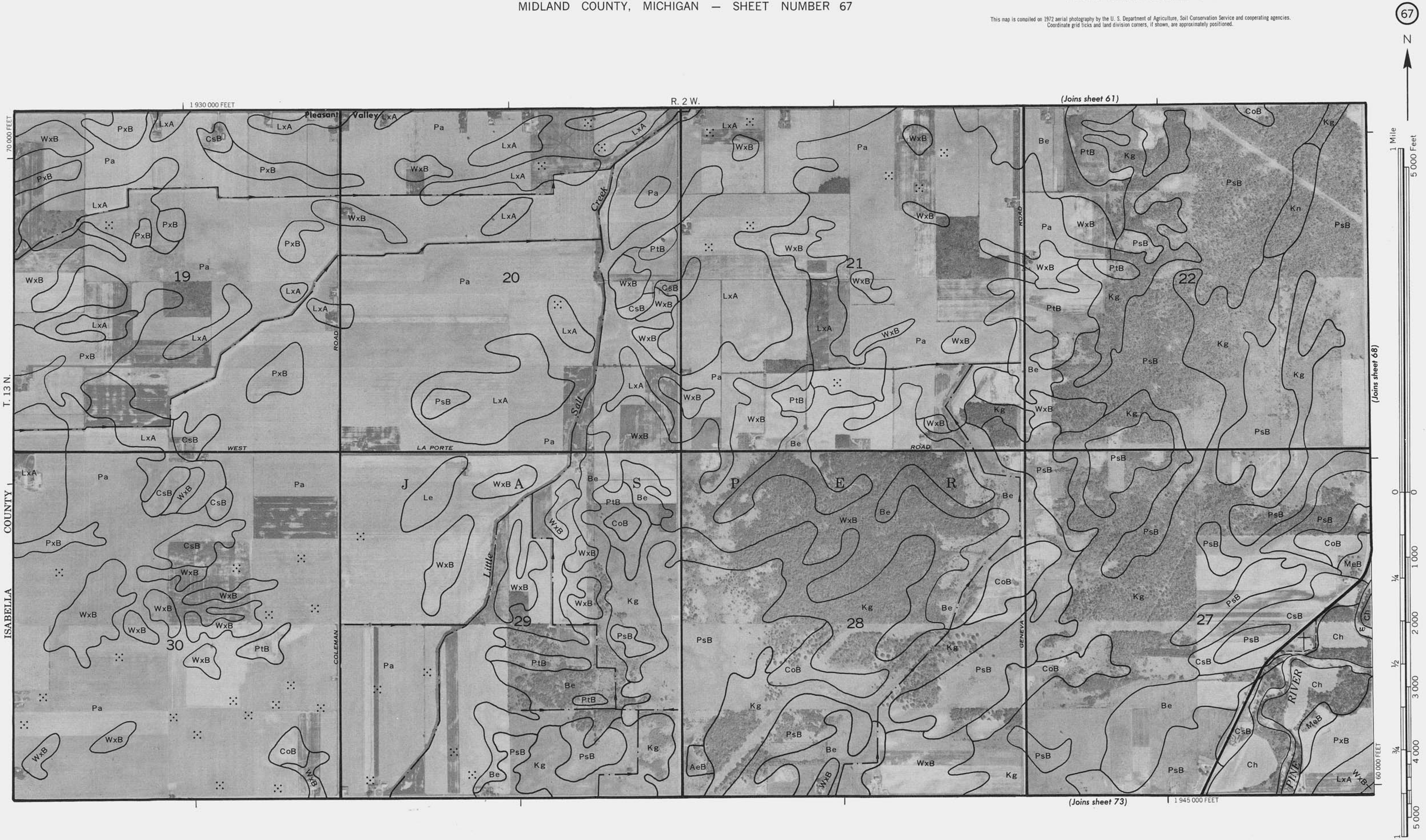
MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 66


N
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
(Joins sheet 60)
R. 2 E.
2 050 000 FEET
80 000 FEET
(Joins sheet 65)
75 000 FEET
T. 13 N.
SAGINAW COUNTY
(Joins sheet 72)
2 035 000 FEET
I N G E R S O L L
14
13
23
24
Shaffner and Major Drain
FREELAND ROAD
ROAD
CROSSING
SMITH
Drain
Bennett Drain
Pe
Le
WxB
InB
AeB
OaB
PsB
CsB
CoB
BoB
PxB

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 67

MIDLAND COUNTY, MICHIGAN NO. 67

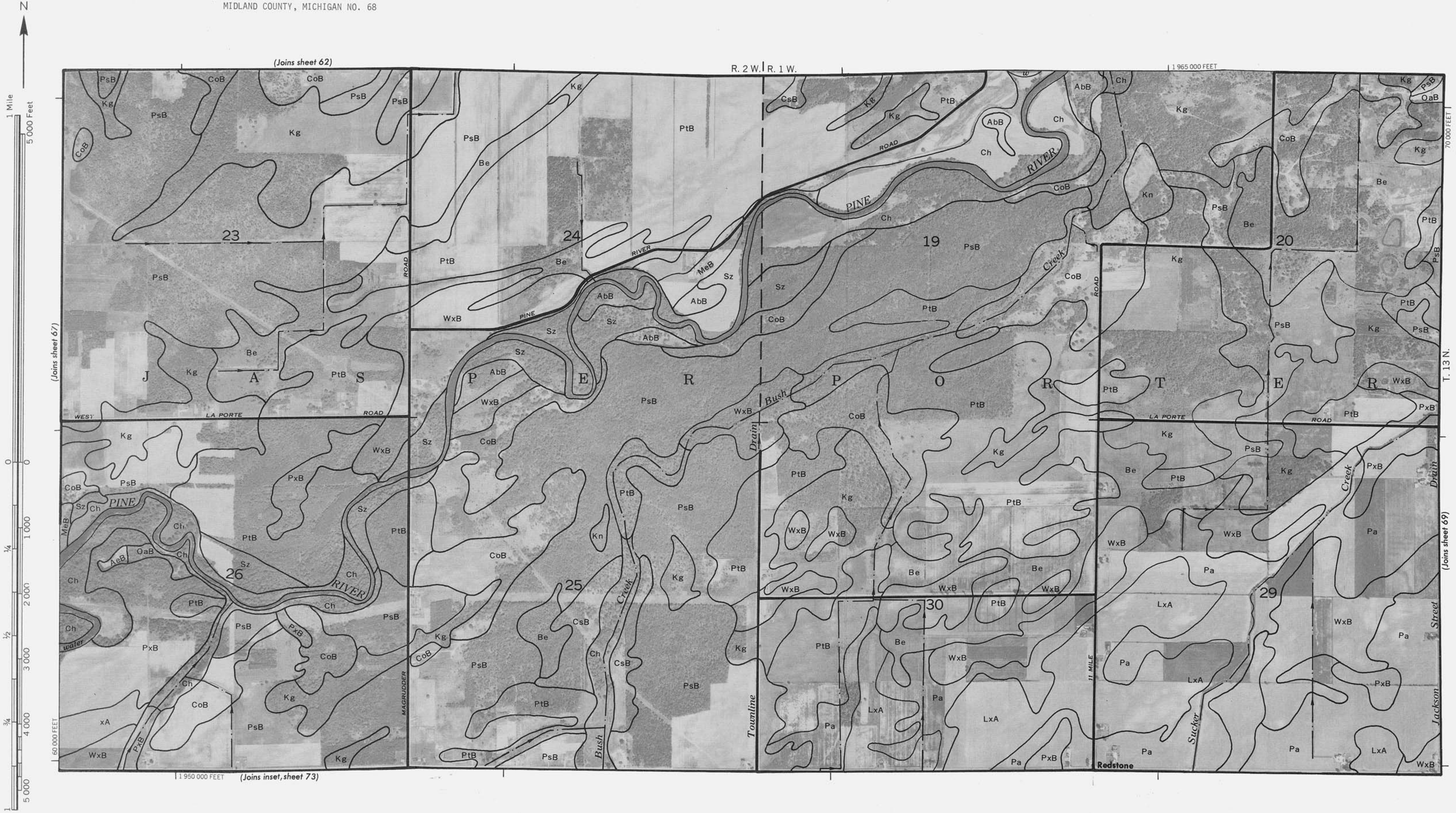
This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


67
N
(Joins sheet 61)
(Joins sheet 68)
(Joins sheet 73)
R. 2 W.
T. 13 N.
ISABELLA COUNTY
1 930 000 FEET
70 000 FEET
1 945 000 FEET
60 000 FEET
Pleasant Valley
Salt Creek
Little
JASPER
PINE RIVER
WEST LA PORTE ROAD
COLEMAN ROAD
GENEVA ROAD
ROAD
19
20
21
22
27
28
29
30
PxB
LxA
CsB
WxB
Pa
PsB
PtB
Le
CoB
Be
Kg
Kn
AeB
MeB
Ch
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 68

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

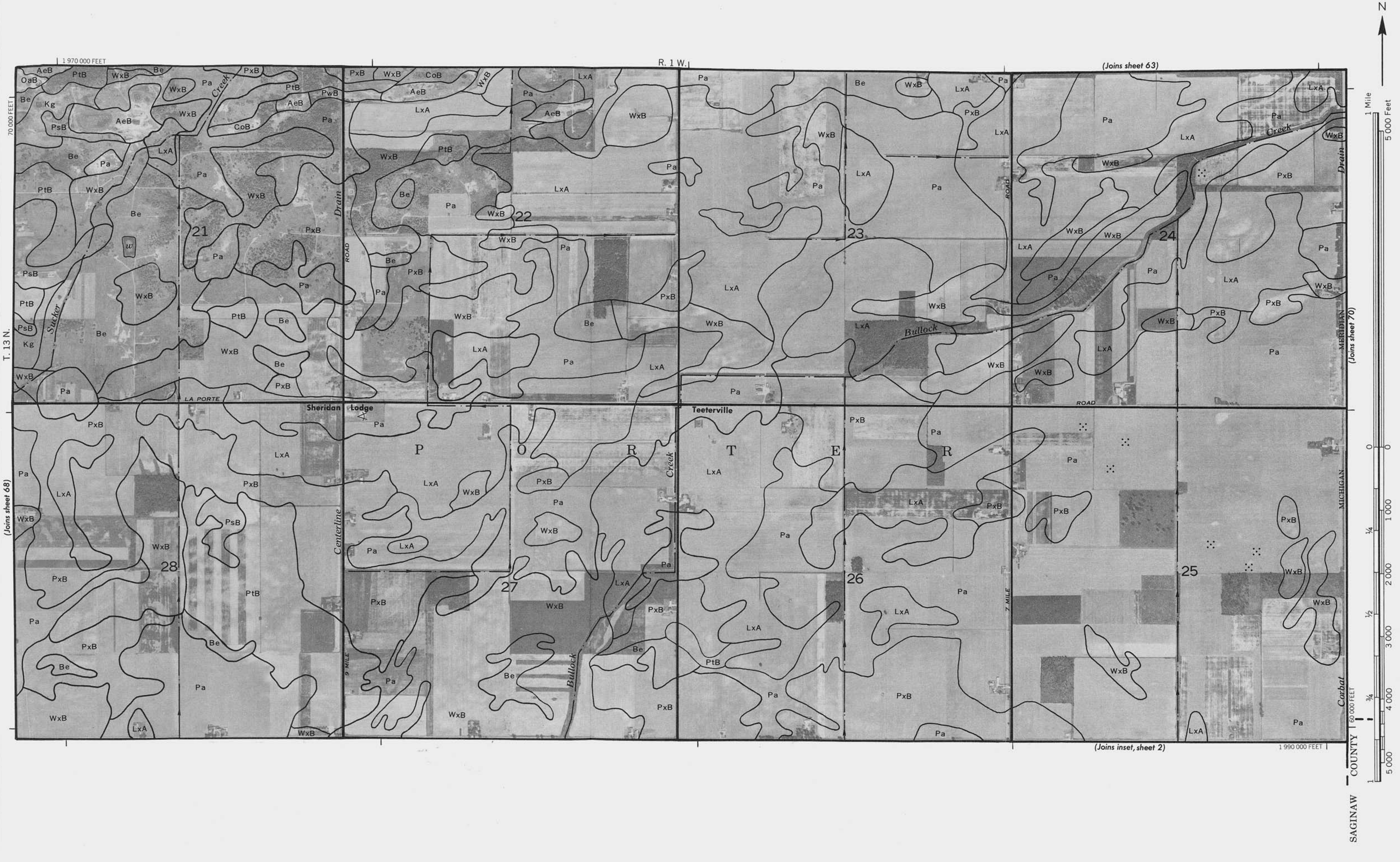
MIDLAND COUNTY, MICHIGAN NO. 68


N
1 Mile
5 000 Feet
0
0
1000
¼
2000
½
3000
¾
4000
1
5000
(Joins sheet 62)
R. 2 W. | R. 1 W.
1 965 000 FEET
70 000 FEET
T. 13 N.
(Joins sheet 67)
(Joins sheet 69)
60 000 FEET
1 950 000 FEET
(Joins inset, sheet 73)
23
24
19
20
26
25
30
29
J A S P E R P O R T E R
WEST LA PORTE ROAD
LA PORTE ROAD
PINE RIVER
PINE RIVER ROAD
ROAD
MAGRUDDER
Townline
Bush Drain
Bush Creek
Creek
11 MILE
Sucker Creek
Creek Drain
Jackson Street
Redstone
water
PsB
CoB
Kg
PtB
Be
WxB
Sz
AbB
MeB
CsB
Ch
Kn
OaB
AeB
MeB
PxB
Pa
LxA
xA

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 69

MIDLAND COUNTY, MICHIGAN NO. 69

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

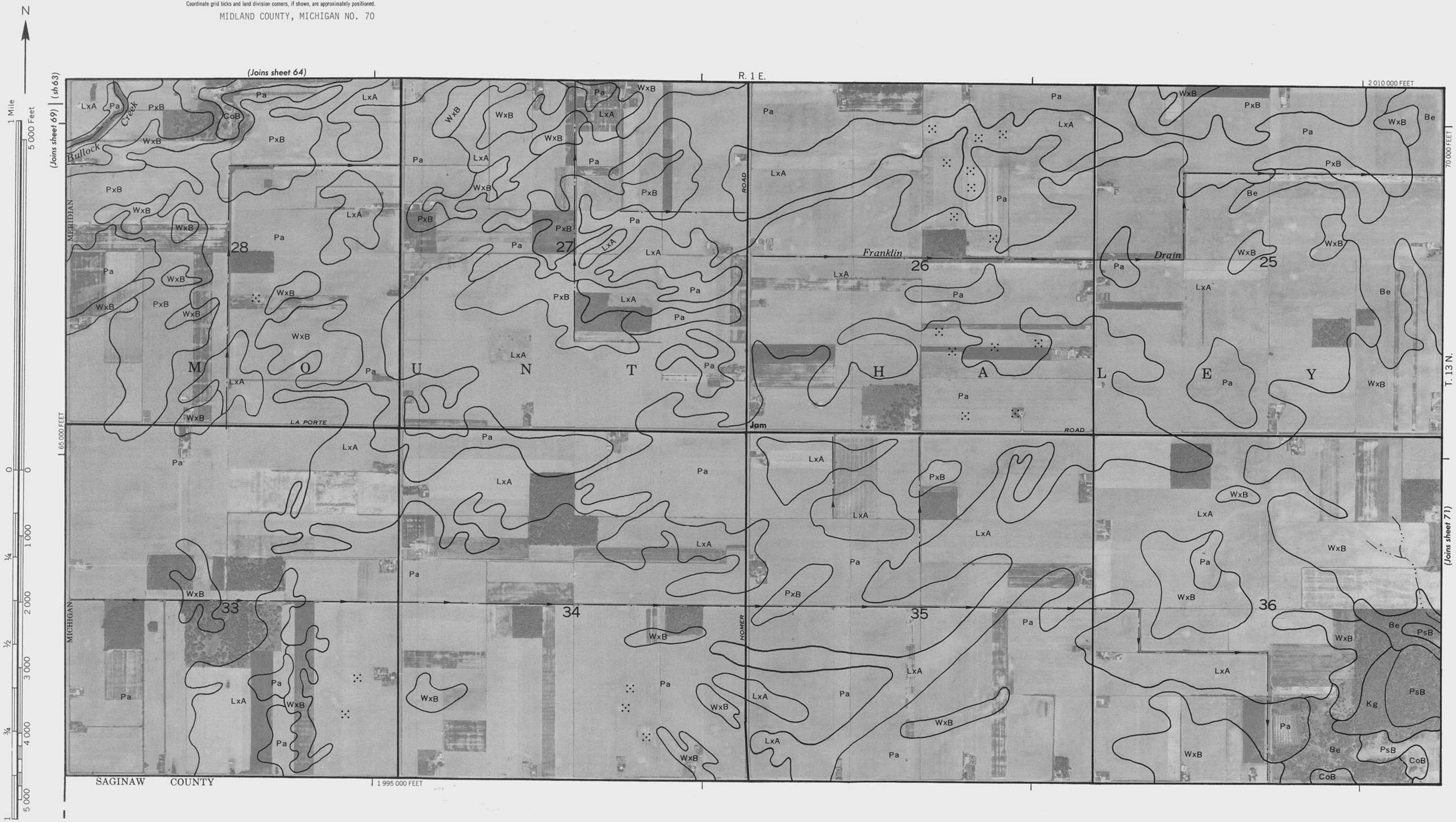

N
1 970 000 FEET
R. 1 W.
(Joins sheet 63)
70 000 FEET
T. 13 N.
(Joins sheet 68)
(Joins sheet 70)
(Joins inset, sheet 2)
1 990 000 FEET
60 000 FEET
21
22
23
24
25
26
27
28
Sucker
Creek
Drain
ROAD
LA PORTE
Sheridan
Lodge
Teeterville
P
O
R
T
E
R
Bullock
Creek
Centerline
9 MILE
7 MILE
ROAD
MERIDIAN
MICHIGAN
Corbat
Drain
Creek
SAGINAW
COUNTY
AeB
OaB
PtB
WxB
Be
Kg
PsB
PxB
Pa
PtB
AeB
PwB
CoB
LxA
w
PsB
Kg
WxB
LxA
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
0
1000
2000
3000
4000
5000

70

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 70

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

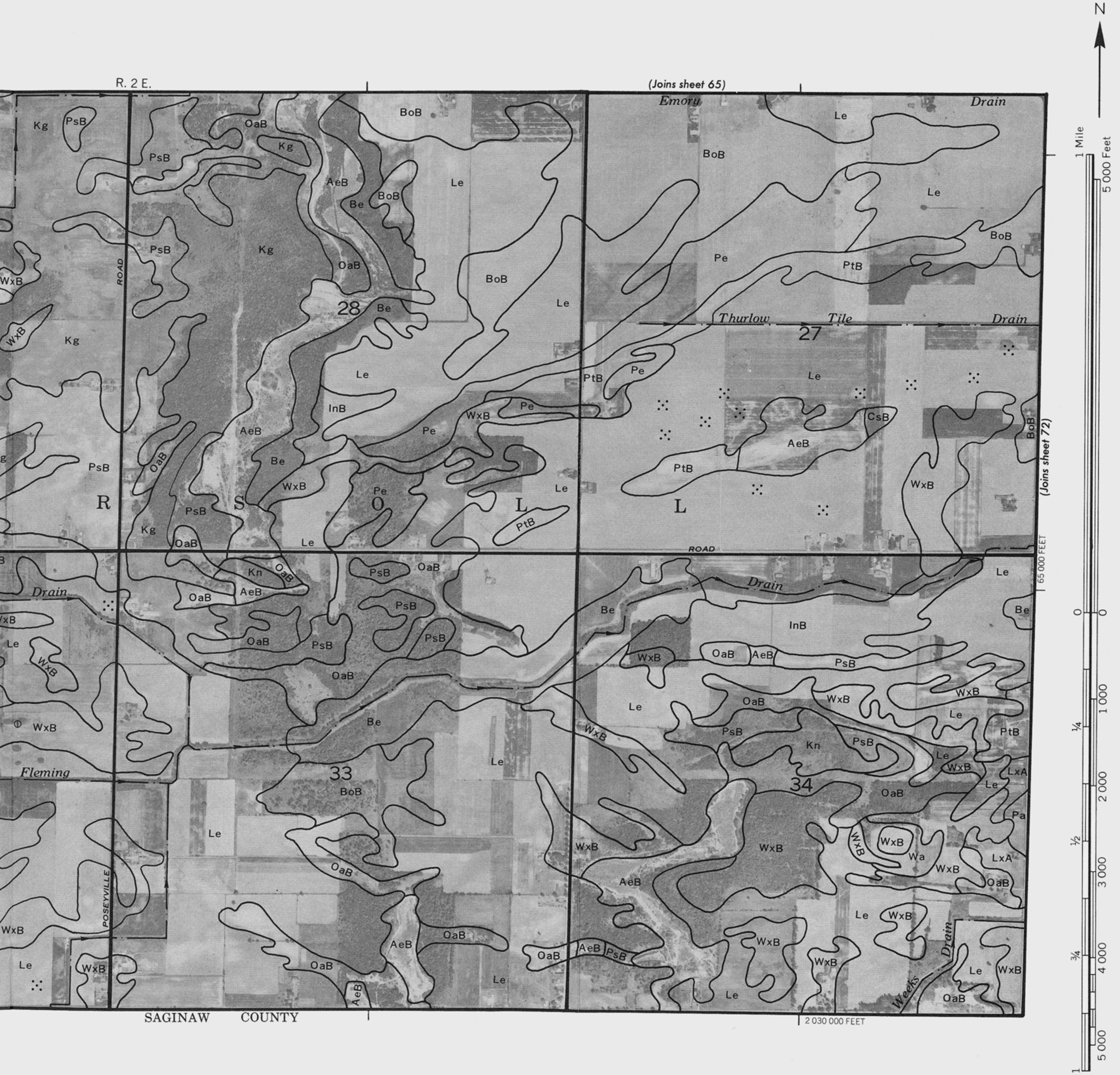
MIDLAND COUNTY, MICHIGAN NO. 70

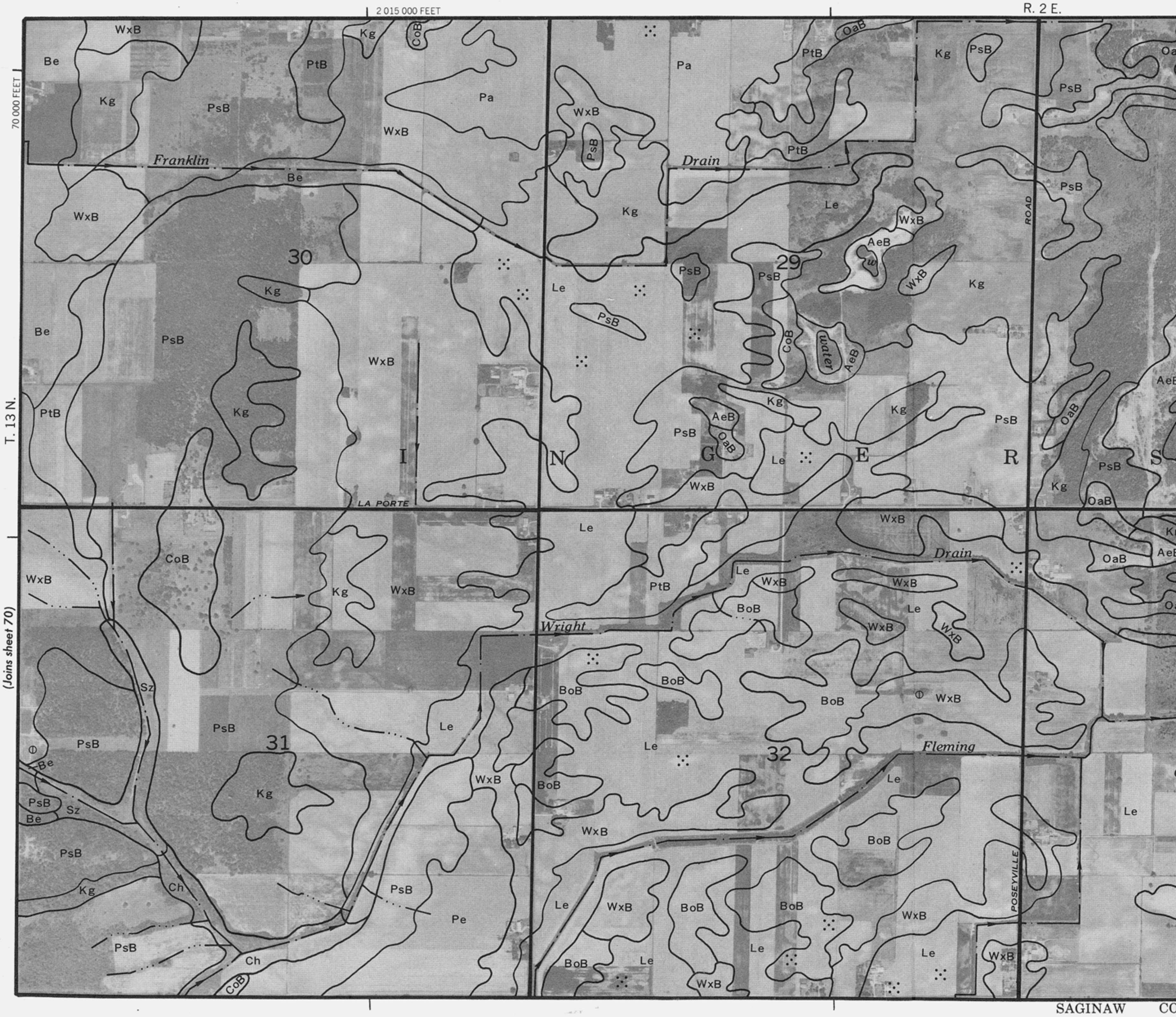

N
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
(Joins sheet 64)
R. 1 E.
2 010 000 FEET
70 000 FEET
T. 13 N.
(Joins sheet 71)
(Joins sheet 69) | (sh63)
65 000 FEET
1 995 000 FEET
SAGINAW COUNTY
MERIDIAN
MICHIGAN
LA PORTE
ROAD
HOMER
ROAD
Jam
Franklin
Drain
Bullock
Creek
28
27
26
25
33
34
35
36
M O U N T H A L E Y
Pa
LxA
WxB
PxB
CoB
Be
PsB
Kg

COUNTY, MICHIGAN — SHEET NUMBER 71

MIDLAND COUNTY, MICHIGAN NO. 71

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

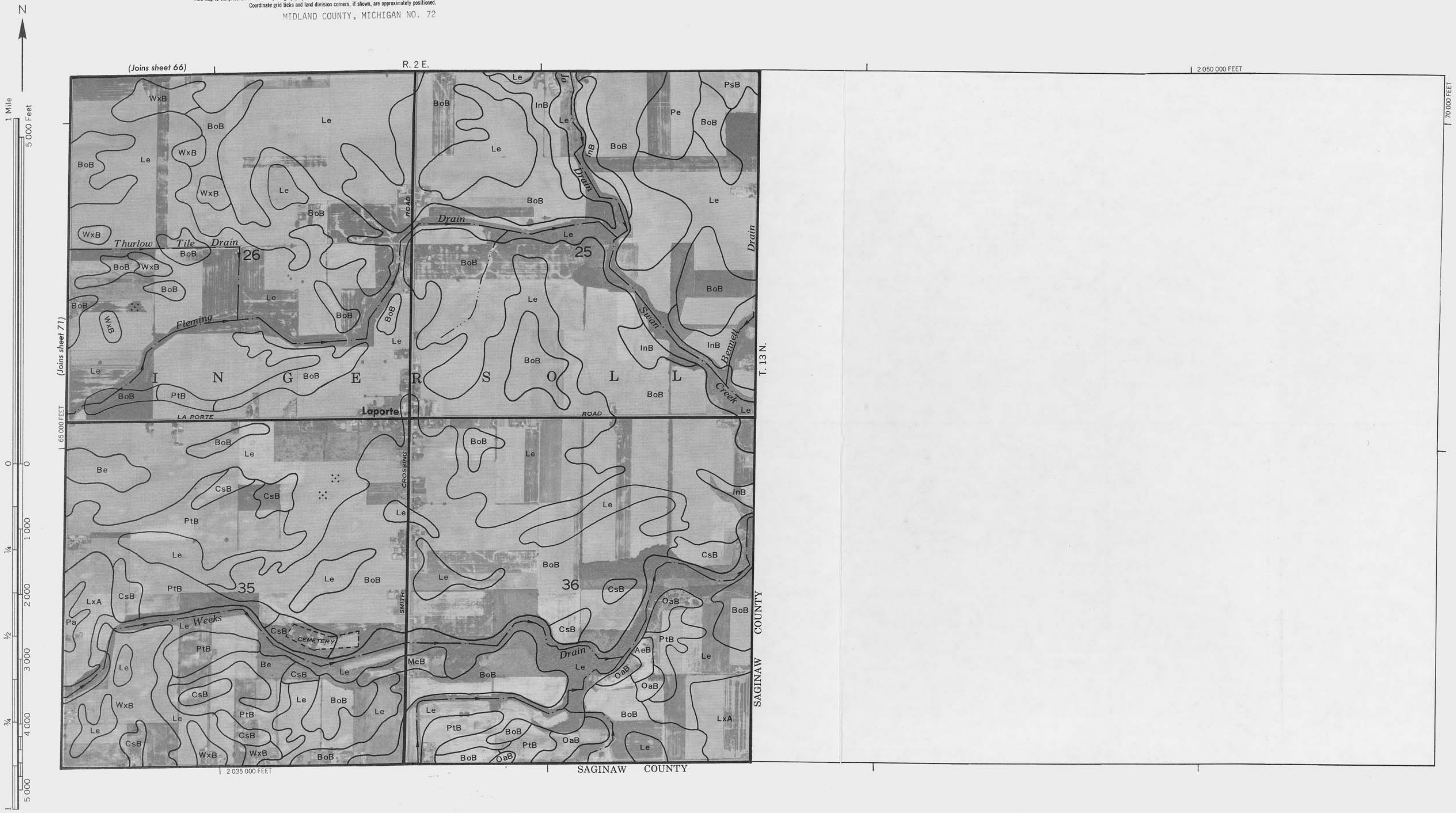

N
R. 2 E.
(Joins sheet 65)
Emory Drain
Thurlow Tile Drain
Drain
Fleming
Weeks Drain
ROAD
POSEYVILLE
SAGINAW COUNTY
(Joins sheet 72)
65 000 FEET
2 030 000 FEET
28
27
33
34
R S O L L
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
Kg
PsB
OaB
AeB
Be
BoB
Le
Pe
PtB
InB
WxB
CsB
Kn
LxA
Pa
Wa


2 015 000 FEET
R. 2 E.
70 000 FEET
T. 13 N.
(Joins sheet 70)
SAGINAW
CO
30
29
31
32
I
N
G
E
R
S
Franklin
Drain
Wright
Fleming
Drain
LA PORTE
ROAD
POSEYVILLE
water
w
Be
Kg
PsB
PtB
WxB
CoB
Pa
Le
AeB
OaB
BoB
Sz
Ch
Pe

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 72

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

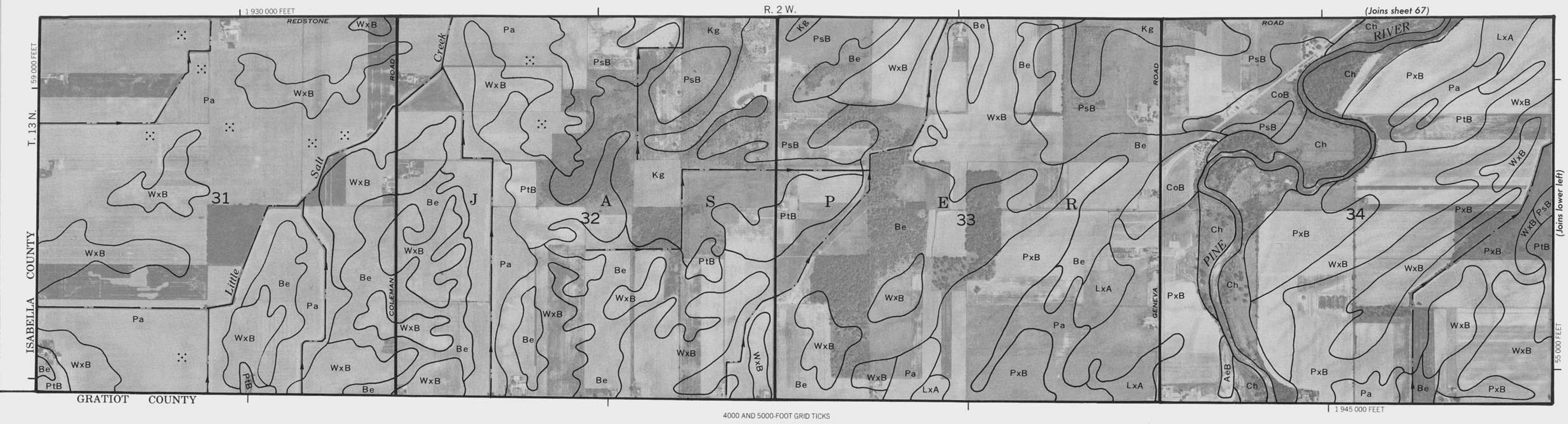
MIDLAND COUNTY, MICHIGAN NO. 72


N
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
(Joins sheet 66)
R. 2 E.
2 050 000 FEET
70 000 FEET
(Joins sheet 71)
65 000 FEET
2 035 000 FEET
T. 13 N.
SAGINAW COUNTY
I N G E R S O L L
Laporte
LA PORTE ROAD
ROAD
CROSSING
SMITH
CEMETERY
Thurlow Tile Drain
Fleming
Drain
Swan
Creek
Bennett
Weeks
26
25
35
36
WxB
BoB
Le
PsB
Pe
InB
PtB
Be
CsB
LxA
Pa
MeB
OaB
AeB

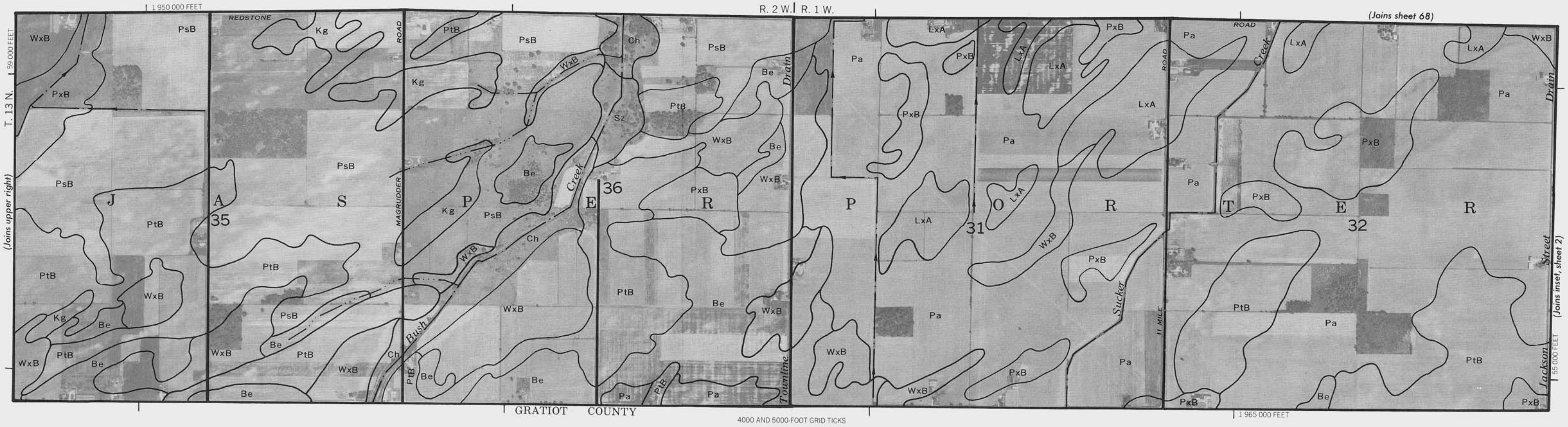
MIDLAND COUNTY, MICHIGAN NO. 73

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MIDLAND COUNTY, MICHIGAN — SHEET NUMBER 73


1 930 000 FEET
R. 2 W.
(Joins sheet 67)
59 000 FEET
T. 13 N.
ISABELLA COUNTY
GRATIOT COUNTY
(Joins lower left)
55 000 FEET
1 945 000 FEET
4000 AND 5000-FOOT GRID TICKS
REDSTONE
COLEMAN ROAD
ROAD
GENEVA
Salt
Little
Creek
PINE
RIVER
JASPER
31
32
33
34
Pa
WxB
Be
PtB
PsB
Kg
Ch
CoB
PxB
LxA
AeB

INSET


1 950 000 FEET
R. 2 W. | R. 1 W.
(Joins sheet 68)
59 000 FEET
T. 13 N.
(Joins upper right)
(Joins inset, sheet 2)
55 000 FEET
1 965 000 FEET
GRATIOT COUNTY
4000 AND 5000-FOOT GRID TICKS
REDSTONE
ROAD
MAGRUDDER
Bush
Creek
Towntine
Drain
Sucker
11 MILE
Jackson
Street
Drain
JASPER
PORTER
35
36
31
32
WxB
PxB
PsB
PtB
Kg
Be
Ch
Sz
Pa
LxA

N

1 Mile

5 000 Feet

0

1000

¼

2000

½

3000

¾

4000

1

5 000